# CHAPTER 6

# RESERVATION NATURAL RESOURCES

## I. Physical Environment and Climate.

The Northern Cheyenne Indian Reservation is located in the Powder River Basin in southeastern Montana. It is located in the Northern Great Plains physiographic province and is part of the Yellowstone River Subbasin, which in turn is part of the Missouri River Basin. Drainage is generally northward by way of Rosebud Creek and the Tongue River. The Reservation is bordered on the west by the Crow Indian Reservation; on the east by the Tongue River; on the south by Cook Creek and the line dividing Townships 5 and 6 south; and on the north by the line dividing Townships 1 and 2 south. (HKM, 1982). It occupies portions of Big Horn and Rosebud Counties, with a total surface area of approximately 444,500 acres.

The general topography of the region is varied with long narrow ridges, extensive hillsides, and generally narrow flood plains. The altitudes within the Reservation range from about 4,730 feet above mean sea level (amsl) southeast of Busby to about 2,920 feet amsl on the Tongue River north of Ashland, Montana. The Reservation is within the unglaciated portion of the Missouri Plateau of the Northern Great Plains Province. The central portion of the Reservation is an upland plateau, which rises 800 to 1000 feet above the surrounding terrain, and is underlain by relatively flat-lying beds of the Fort Union Formation of Paleocene age. (HKM, 1975). This upland plateau has been deeply dissected by the Tongue River, Rosebud Creek, and their tributaries.

The woody vegetation on the uplands consists mostly of Ponderosa (yellow) Pine, while cottonwood trees predominate along the streams. Grasses dominate lower elevations with bluestem (western) wheatgrass and blue grama being the most common. The predominant shrub is big sagebrush, but broom snakeweed, silver sagebrush, fringed sagebrush, and skunkbrush are also common. (BOR, 1995).

The climate of the Northern Cheyenne Reservation is continental and semi-arid characterized by abundant sunshine, moderate relative humidity, moderate winds, low to moderate amounts of precipitation, and wide daily and seasonal variations in temperature. (HKM, 1982). The mean annual temperature is about 45 degrees Fahrenheit (F) with minimum and maximum temperatures ranging from -30 to above 100 degrees F. (BOR and the Northern CheyenneTribe, 1997). Precipitation in the area varies from month to month. Mean annual precipitation ranges from 10-14 inches in the lower elevations, to 15-19 inches in the higher elevations. About half of the annual precipitation occurs from April to June. (BOR and the Northern Cheyenne Tribe, 1997).

## II. Water Resources.

The Northern Cheyenne Water Code identifies clearly the importance of the Tribal water resources and guidelines and provisions for water management, permitting and enforcement. The first two findings of the Code state:

- "The management and protection of water is a central attribute of tribal sovereignty and is vital to the health and welfare of the Reservation residents and to the vitality of the Reservation economy and environment," and

- "The water resource has cultural, spiritual, social, environmental and economic values that require protection and must guide the appropriate use and management of all resources in the watershed and drainage basins of the Reservation."

As with most communities within the arid western United States, the Northern Cheyenne Reservation is dependent upon a limited quantity of water, subject to laws and management governing the apportionment and use of such water. The quantity of surface water, including alluvial water, available to the Tribe, has been legally defined and set forth in detail and in a manner specific to the Tribe through the settlement of Winters Rights and through a compact with the State of Montana. The quality of surface water is governed by federal and state law and will soon be regulated by the Tribe pending the adoption of the draft water quality standards. Governance of groundwater is less well defined but is logically linked by association with surface water. The purpose of this water resources section is to describe the water resources of the Tribe and relationships between water resources on and off the Reservation.

### A. Surface Water.

Map 4-3 of the Montana Statewide Draft Oil and Gas Environmental Impact Statement and Amendment of the Powder River and Billings Resource Management Plans (Predicted Number of CBM Wells by Watershed for Expanded Development Scenarios Regardless of Ownership) shows the estimated number of CBM wells by watershed. The principal watersheds of concern to the Reservation are the Rosebud Creek and Tongue River basins. Within the Montana CBM development area, these basins are estimated to have the greatest number of CBM wells developed in the future at 5,810 (Upper Tongue), 5,400 (Rosebud) and 5,180 (Lower Tongue) wells.

#### 1. The Tongue River Basin.

The Tongue River has been studied extensively and many of the reports encountered are connected with studies of Northern Cheyenne Water Rights investigations and the Tongue River Dam Project. Much of the information presented in this section comes from reports associated with these studies.

The relationship of the Reservation to that of the general hydrologic workings of the region is critical to this section. The eastern portion of the Northern Cheyenne Reservation is located within the Tongue River basin, a tributary to the Yellowstone River, which is a tributary to the Missouri River. The Tongue River basin is extensive within both Wyoming and Montana.

Water resource issues are somewhat complicated due to the large contributing area associated with the watershed upstream of the Reservation. Generally among drainage basins of similar morphology, the larger will produce proportionately more runoff than the smaller, but also due to its greater size, it will tend to encompass a greater range and extent of upstream uses and associated impacts. Such upstream uses may be quite diffuse with regard to their aerial distribution throughout the watershed but may in fact constitute a significant collective impact to downstream users.

The fact that the Tongue River crosses state boundaries also increases risk and difficulty in the management of Tribal water resources, due largely to variation in state water policies and jurisdictions. Given the complexities of large-scale watershed management and the mobile nature of surface water, the condition of the Tribe's water resources is tied to off-Reservation land and water uses. Impacts to Tribal water resources may be cumulative in nature and effect. These off-Reservation watershed areas are included in the affected environment section of the Northern Cheyenne Reservation.

### 2. Principal Drainages.

The Tongue River and Rosebud Creek watersheds are the two principal drainages associated with the Northern Cheyenne Reservation. A small portion of the Sarpy Creek drainage area is present on the northwest corner of the Reservation. The Bighorn basin is not directly connected to the watersheds of the Reservation, yet the Tribe holds reserved water rights to a portion of the Bighorn River and it is therefore relevant as part of the affected environment of the Reservation. These drainages are summarized in Table 6-1 according to their relationship to the Yellowstone River.

There are many small tributaries to the Tongue River and Rosebud Creek. Some of Tongue River tributaries contribute flow upstream of the Reservation and along the Reservation's eastern boundary. Hanging Woman and Otter Creeks represent the main, off-Reservation tributaries, discharging from upstream of the Reservation, to the Tongue River from the east.

Second order tributaries tend to exhibit flow-gaining reaches in the headwaters of their drainages, which diminish with decreasing elevation. This is a function of higher precipitation and groundwater input occurring at higher elevations. Many of tributaries of the Tongue River and Rosebud Creek are intermittent and ephemeral in nature and are prone to occasional flooding. Maximum, minimum and average annual flows for the Yellowstone, Tongue and Rosebud Creek were calculated based on published USGS data for the shared period 1980-1999, these are shown in Table 6-2.

**Table 6-1.** Tributaries of the Yellowstone River associated with the Northern Cheyenne Reservation.

| Major Tributary | First Order Tributary | Second Order Tributary | Origin On-Off Reservation |
|---|---|---|---|
| Yellowstone River | Tongue River | Hanging Woman Creek | Off |
| | | Prairie Dog Creek | Off |
| | | Cook Creek | Off |
| | | Tie Creek | On |
| | | Logging Creek | On |
| | | Pawnee Creek | On |
| | | Kelty Creek | On |
| | | Otter Creek | Off |
| | | Stebbens Creek | On |
| | | Reservation Creek | On |
| | Rosebud Creek | Corral Creek | Off |
| | | Trail Creek | On |
| | | Davis Creek | Off |
| | | Indian Coulee | On |
| | | Muddy Creek | On |
| | | Lynch Creek | Off |
| | | Lame Deer Creek | On |
| | | Greenleaf/Rye Grass Creek | On |
| | Sarpy Creek | Small portion of headwaters | On |
| | Bighorn River | | Off |

Adapted from USBR, 1995

The Yellowstone is the principal regional drainage of southern Montana and is tributary to the Missouri. The Yellowstone River flows predominantly east, northeast across Montana and passes through Forsyth, Montana about 45 miles north of the northern boundary of the Reservation. The Yellowstone joins the Missouri River in North Dakota about 30 miles east and downstream from the Montana border.

**Table 6-2** – Twenty Year Maximum, Minimum and Average Annual Flows for Streams Relevant to the Northern Cheyenne Indian Reservation in Acre-Feet per Year. (USGS Records, 1980-1999)

| USGS # | Stream | Maximum | Minimum | Average |
|---|---|---|---|---|
| 6295000 | Yellowstone River at Forsyth, MT | 13,082,083 | 5,017,815 | 7,943,257 |
| 6295113 | Rosebud Creek at Reservation Bndry near Kirby, MT | 8,326 | 1,919 | 4,856 |
| 6295250 | Rosebud Creek near Colstrip, MT | 20,343 | 3,323 | 11,095 |
| 6307500 | Tongue River at Tongue River Dam near Decker, MT | 474,198 | 153,481 | 294,691 |
| 6308500 | Tongue River at Miles City, MT | 425,693 | 124,522 | 266,565 |
| 6309000 | Yellowstone River at Miles City, MT | 13,024,165 | 5,262,516 | 8,253,983 |

*a. Tongue River.*

The headwaters of the Tongue River are located in the Bighorn Mountains, within Wyoming, to the southwest of the Reservation. The Tongue River flows about 265 miles from its headwaters to its point of confluence with the Yellowstone River at Miles City, MT, and comprises the entire 47-mile eastern boundary of the Reservation. Over this distance

elevation ranges from about 123,000 feet to about 2,400 feet at Miles City, Montana. Precipitation ranges from 40 to 14 inches per year. The Tongue River flows in a fairly stable manner, in contrast to its lower tributaries and lower watersheds such as Rosebud Creek, which tend to be intermittent and are not sustained by snow pack. Annual peaks occur in May and June resulting from spring rains and melting snow pack, with a period of low flow following throughout the fall and winter. The Tongue River's main tributaries include Hanging Woman Creek, which enters the Tongue River upstream of the Reservation, Otter Creek, which enters the Tongue River along the eastern boundary of the Reservation, and Pumpkin Creek, which joins the Tongue downstream from the Reservation.

Figure 6-1 shows the greater Tongue River Watershed and the Northern Cheyenne Indian Reservation. About 32% (or about 1,607 square miles) of the total watershed area lies within Wyoming, while the remainder is located in Montana. The contributing area of the Tongue River watershed at its confluence with Cook Creek (the southeastern point of the boundary of the Reservation) is 2,588 square miles. The contributing area at the northeastern corner of the Reservation is 3,629 square miles. (HKM, TRB Hydrology, 1983).

*i. Natural Flow Estimates.*

HKM conducted a natural flow analysis to estimate undepleted flows of the Tongue River, which would be expected to occur at the Tongue River Gage (at Tongue River Dam), at the Tongue River gage below Brandenberg Bridge and at points corresponding to the Reservation's southeastern and northeastern corners. (1983). The study period for this analysis was 1940-1982 and was accomplished by analysis of gaged flow records from the gages appearing in Table 6-3.

**Table 6-3** - Stream Gages and Available Flow Records for the Tongue River between Tongue River Reservoir and Tongue River below Brandenberg Bridge. (Adapted from HKM, 1983, TRB Hydrology, 1983)

| Station Name | Period of Record | Station Number | Drainage Area (Square Miles) |
|---|---|---|---|
| Tongue River at Tongue River Dam, near Decker, MT[1] | May 1939 to 1982 | 06307500 | 1,770 |
| Tongue River below Hanging Woman Creek near Birney, MT[2] | May 1967 to October 1973 | 42C 02000 | 2,552 |
| Tongue River at the southern Reservation boundary[3] | April 1976 to September 1979 | Tongue River #2 | 2,588 |
| Tongue River at Birney Day School Bridge, near Birney, MT[1] | October 1979 to 1982 | 06307616 | 2,621 |
| Tongue River at the northern Reservation boundary[3] | June 1977 to September 1979 | Tongue River #1 | 3,629 |
| Tongue River below Brandenberg Bridge, near Ashland, MT[1] | October 1979 to 1982 | 06307830 | 4,062 |

1 USGS, Water Resources Data, Montana, Volume 1, 1981 and provisional 1982 data from the Billings, Montana office of the USGS.

2 Department of Natural Resources, Montana Surface Water Records, Yellowstone River Basin, September 1977.

3 NCRP, Hydrologic Impacts from Potential Coal Strip Mining - Northern Cheyenne Reservation, Volume II, 1981.

Table 6-4 shows the average annual gage flows and estimated natural flows for the Tongue River and Brandenberg gages, along with the estimated natural flows expected to occur at the Reservation boundaries, based on the study period 1940-1982.

**Table 6-4** - Average Annual Gage and Estimated Natural Flows for the Tongue River near the Northern Cheyenne Reservation. (study period 1940-1982, HKM, 1983)

| Location | Flow Type | Acre-Feet/Year |
|---|---|---|
| Tongue River at Tongue River Dam | Gage Flow | 332,907 (St. Dev.=112,406) |
| | Est. Natural Flow | 421,238 (St. Dev.=102,464) |
| Southern Boundary of Reservation | Est. Natural Flow | 439,253 (St. Dev.=106,154) |
| Northern Boundary of Reservation | Est. Natural Flow | 455,161 (St. Dev.=103,255) |
| Tongue River at Brandenburg Bridge | Gage Flow | 362,614 (St. Dev.=152,288) |
| | Est. Natural Flow | 461,019 (St. Dev.=104,352) |

*ii. Descriptions of Select Tongue River Tributary Basins.*

There are many tributaries to the Tongue River upstream of the Reservation. Land use within these tributary basins is important to the hydrology of the Reservation because natural surface drainage from these watersheds can effectively accumulate and transport pollutants into the Tongue River. The principal drainages are described below.

1. Hanging Woman Creek

The watershed of Hanging Woman Creek receives about 12 inches of precipitation annually and drains an area east of the Tongue River. Of the Tongue River tributaries within Montana and upstream of the Reservation, the Hanging Woman Creek watershed is the largest in area and annual discharge, at 516.8 square miles and 7,500 acre-feet per year, respectively. Its confluence with the Tongue is just upstream of the Town of Birney or about six river miles upstream from the southern Reservation boundary. (Cannon, 1989).

Extensive CBM development in the Wyoming portion of the Hanging Woman Creek watershed was not addressed in the Draft CBM EIS. (BLM, 2002). Facilities and storage reservoirs associated with existing CBM development are common throughout this area similar to that of the drainages west of the Tongue River near Decker, Montana. Such facilities are visible and include storage impoundments commonly constructed within small tributary drainages for purposes of containing water extracted from wells as part of CBM recovery.

2. Prairie Dog Creek

Prairie Dog Creek is an intermittent stream formed by a small drainage south of the Reservation feeding the Tongue River from the east. It is typical of the smaller drainages that incise the slopes from the Wolf Mountains west of the Tongue River. This area is characterized as relatively steep and dissected from the Tongue River Valley, upslope up to the tributary headwaters region, which is

considered a plateau-like erosional remnant. (Cary, 1982). These creeks receive the majority of flow from precipitation and groundwater accretions within the upper reaches of their drainages.

The watershed of Prairie Dog Creek receives about 13 inches of precipitation annually and is approximately 25 square miles in area. Based on a short USGS record, the creek produced 29 acre-feet of runoff during the water year 1979-1980, at a gage representing about 19 square miles of the total watershed. (Cary, 1982). Prairie Dog Creek is similar to Bull Creek, which is the next downstream tributary, the headwaters of which drain a small part of the Reservation to lands off the Reservation.

3. Cook Creek

Cook Creek derives its flow from surface water runoff and groundwater input, however groundwater is the dominant source. (NCRP, 1981). Cook Creek forms the southern boundary of the Northern Cheyenne Reservation, from the 10th Guide Meridian, west and is within the Lower Tongue Basin. (BLM, 2002). Its confluence with the Tongue River defines the southeast point of the Reservation and the corner at which the Tongue River begins the eastern boundary of the Reservation. The watershed of Cook Creek receives about 13 inches of precipitation annually and drains Reservation and non-Reservation lands, west of the Tongue River.

At its confluence with the Tongue River, approximately four miles downstream from the Town of Birney, Cook Creek's watershed is about 70 square miles producing an average annual flow of about 4,500 acre-feet per year. (Cannon, 1982). The average elevation of the watershed is about 3,800 feet. Various potential damsites were located on Cook Creek for purpose of storing water. (HKM, 1974). HKM describes Cook Creek as an intermittent, spring fed stream, which is prone to moderate flooding.

4. Otter Creek

Otter Creek is an important drainage within the vicinity but off of the Reservation. Otter Creek's watershed is about 710 square miles and is directly tributary to the Tongue River adjacent to the Reservation. For its relatively large area, Otter Creek generates only a small average annual flow of about 3,502 acre-feet per year, according to the USGS gage 06307740 at Ashland, for 1973-1994. However, this large watershed is capable of producing large peak flow events. The confluence of Otter Creek and the Tongue River is located near the town of Ashland. Most of the land area drained by Otter Creek is part of Custer National Forest, though the mainstem is surrounded by private surface, which is underlain by federal and private minerals.

According to short-term precipitation data, the upper Otter Creek watershed received about 19 inches of precipitation annually during the period 1983-1984 as measured at 4,064 feet elevation. During this period, 13.3 inches of annual average precipitation was measured at Birney, at 3,190 feet elevation. (McClymonds, 1988). Precipitation near Ashland is closer to 13 inches per year, which explains the characteristic gaining nature of the stream in the upper reaches and flows that diminish at lower elevations.

5. Tongue River Tributaries on the Reservation

The main creeks draining from within the Reservation directly to the Tongue River include Tie, Logging, Pawnee, Kelty, Stebbens and Reservation Creeks. The area drained by these creeks is generally east sloping and opposite the Rosebud Creek drainage to the west. The drainage area formed by these tributaries is considered part of the Lower Tongue Basin. (BLM, 2002). According to the NCRP (1981), Logging Creek is supported by both surface water runoff and groundwater discharge. Because of the similarity of Logging Creek to other creeks draining the eastern part of the Reservation, it is likely that the hydrology is also similar for these creeks.

- Tie Creek contributes flow directly to the Tongue River, draining an area entirely within the boundaries of the Reservation. At its confluence with the Tongue, Tie Creek has a watershed area of about 52 square miles, which receives about 13 inches of precipitation per year and produces an annual average discharge of about 3,770 acre-feet.

- Logging, Pawnee and Kelty Creeks receive about 13 inches of precipitation per year and collectively drain an area of about 95 square miles entirely within the Reservation to the Tongue River.

- Stebbens and Reservation Creeks have a combined watershed area of about 50 square miles, which is within the Reservation boundaries. The area receives about 14 inches of annual precipitation and contributes about 4,060 acre-feet per year to the Tongue River.

*b. Rosebud Creek.*

Rosebud Creek drains the western part of the Reservation and receives flow from surface water runoff and groundwater input, mostly from within the Reservation. The headwaters of Rosebud Creek are centered near the southwestern corner of the Northern Cheyenne Reservation and occupy non-Reservation areas to the south and Crow Indian Reservation lands to the west and southwest, in the Wolf Mountains. Rosebud Creek flows approximately 100 miles with the headwaters at nearly 5,000 feet in elevation and its confluence with the Yellowstone River at about 2,500 feet.

The watershed area at the southern boundary of the Reservation is slightly over 100 square miles and about 640 square miles at the northern boundary of the Reservation, a distance of about 30 miles. The watershed receives about 15 inches of average annual precipitation and produces annual flows of 6,850 acre-feet and 25,000 acre-feet at the northern and southern Reservation boundaries respectively.

Lame Deer and Muddy Creeks form the principal drainages within the Reservation. These creeks contribute water to Rosebud Creek at their respective confluences within the Reservation. Other creeks like Rye Grass, Miller and Green Leaf Creeks begin on the Reservation but discharge to Rosebud Creek off of the Reservation. Rosebud Creek is highly variable from year to year and month to month. Peak flows are a result of snowmelt, precipitation and runoff occurring from late winter through midsummer. Maintenance of flow during the remainder of the year is governed to some extent by groundwater input and spring flow. Much of the total accretion of Rosebud Creek takes place on the Reservation and diminishes downstream.

*i. Natural Flow Estimates*

HKM (1982, RCB Hydrology) conducted a streamflow analysis of Rosebud Creek based on correlation of available gage records. In order to develop a more complete understanding of historical stream flow in Rosebud Creek, HKM correlated these data with complete and long-term data from a selected reach of the Bighorn River. The resulting synthetic gage record for Rosebud Creek was assumed to closely approximate natural flow conditions of Rosebud because depletions are considered negligible.

In this analysis flow estimates were developed for Rosebud Creek at its mouth, near its confluence with the Yellowstone River, at a location near Colstrip (near the northern Reservation boundary) and near the southern Reservation Boundary (just downstream of Kirby). The study period for this analysis was 1939-1981 and was accomplished by analysis of gaged flow records from the gages appearing in Table 6-5.

**Table 6-5 -** Stream Gages and Flow Records for Rosebud Creek. (HKM, 1982; RCB Hydrology)

| Station Name | Period of Record | Station Number | Drainage Area (Square Miles) |
|---|---|---|---|
| Rosebud Creek at the Southern Reservation Boundary, near Kirby[1] | June 1977 to 1981 | 06295113 | 102 |
| Rosebud Creek at the Northern Reservation Boundary[2] | June 1977 to 1980 | RC #1 | 638 |
| Rosebud Creek near Colstrip, MT[1] | October 1974 to 1981 | 06295250 | 799 |
| Rosebud Creek near Rosebud, MT[1] | July 1939 to 1981, inc. | 06296003 | 1,302 |
| Muddy Creek 2 | May 1978 to September 1979 | MC #1 | 103 |
| Lame Deer Creek 2 | April 1977 to April 1978, inc. | LDC #1 | 82 |

1 USGS, Water Resources Data, Montana.

2 Northern Cheyenne Research Project, Hydrologic Impacts from Potential Coal Strip Mining - Northern Cheyenne Reservation, Volume II, 1981.

Table 6-6 shows the average annual gage flows and estimated natural flows for Rosebud Creek, along with the estimated natural flows expected to occur at the Reservation boundaries, based on the study period 1939-1981.

**Table 6-6** - Average Estimated Natural Flows for Rosebud Creek, Northern Cheyenne Reservation. (study period 1939-1981)

| **Estimated Natural Flow at Location** | **Acre-Feet/Year** |
|---|---|
| Rosebud Creek at Southern Boundary | 11,818 (St. Dev. = 6,417) |
| Rosebud Creek neat Colstrip, Near Northern Boundary | 26,727 (St. Dev. – 14,172) |
| Rosebud Creek near Mouth, Near Rosebud | 27,297 (St. Dev. = 18,439 |

HKM, RCB Hydrology, 1982.

*ii. Descriptions of Selected Rosebud Creek Tributaries*

1. Muddy Creek

Muddy Creek is one of the major tributaries of Rosebud Creek, within the Reservation. At its confluence with Rosebud Creek, Muddy Creek has a watershed area of about 103 square miles and produces an average annual flow of about 4,540 acre-feet per year. The basin receives an average of about 15 inches of precipitation annually.

2. Black Spring Coulee and Lynch Coulee

Combined, these two tributaries of Rosebud Creek have a watershed area of about 28 square miles, and drain lands from within the Reservation. The watershed receives an average of about 15 inches of precipitation annually and produces an average annual flow of about 1,875 acre-feet per year.

3. Lame Deer Creek

Lame Deer Creek is another major Reservation tributary to Rosebud Creek. It receives an average of about 16 inches per year precipitation and produces a flow of about 5,620 acre-feet per year from a watershed area of about 82 square miles.

4. Rye Grass, Miller and Green Leaf Creeks

These creeks collectively drain about 33 square miles of land before exiting the Reservation. The watersheds receive an average of about 16 inches of precipitation per year. The average annual flow from the Reservation portion of the watershed is about 3,600 acre-feet per year.

*c. Bighorn River*

The Bighorn River drains the western side of the Bighorn Mountains in Wyoming, and part of the eastern Wind River Mountains by virtue of the Wind River, Wyoming. The eastern part of the Absaorka Range of Wyoming is also drained to the Bighorn River by

the Greybull and Shoshone Rivers. The Yellowtail Dam, in Montana, creates the Bighorn Reservoir, which straddles the Wyoming-Montana border.

While no part of the Northern Cheyenne Reservation lies within the Bighorn River basin, the Tribe does have a water right to 30,000 acre-feet of water from Bighorn Reservoir. The Northern Cheyenne -Montana Compact specifically addresses this in under Article II A, Section 7:

> a. Tribal Allocation. As a part of the Tribal Water Right, the Secretary of the Interior shall allocate 30,000 acre-feet per year of stored water in Bighorn Reservoir, Yellowtail Unit, Lower Bighorn Division, Pick-Sloan Missouri Program, Montana, measured at the dam, for use or disposition by the Tribe for any beneficial purpose, either on or off the Reservation, pursuant to the terms of this Compact. This allocation is subject to the prior reserved water rights, if any, of any Indian tribe, or of persons claiming water through that tribe, to that water. Any use or disposition of water from Bighorn Reservoir off the Reservation by the Tribe is subject to the specific provisions relating to such use or disposition in any act of Congress ratifying this Compact.

Holding this water right makes the Tribe a stakeholder in the condition and function of the Bighorn watershed. As the condition and function of the watershed as a resource governs the quantity and quality of Tribal property, it therefore merits presentation as a potentially affected environment.

### 3. Surface Water Storage.

As part of a discussion of Reservation water resources, it is necessary to address existing and proposed surface water storage facilities, relevant to the Reservation. Tongue River Dam is an existing structure impounding water within the Tongue River Reservoir. The Tribe also has water rights to the Bighorn River, from Yellowtail Dam. Water storage facilities considered for Cook and Rosebud Creeks are proposed and represent potential projects considered by the Northern Cheyenne. These potential projects were developed as preliminary designs by HKM (1973 and 1974) for purposes of Reservation water resource investigations.

#### *a. Tongue River Dam*

As a major stakeholder in the Tongue River Project, it is necessary to identify the project as part of the affected environment of the Reservation. The Tongue River Dam is located 15 miles upstream of the southern boundary of the Reservation and was originally completed in 1940. Subsequent modification of the Dam entailed raising the crest height and increasing storage capacity to 80,000 acre-feet. Such modification was specified as a directive to the Secretary of the Interior for several purposes including the partial fulfillment of the Northern Cheyenne Indian Reserved Water Rights Settlement Act of 1992.

According to the Tongue River Basin Project, Final Environmental Statement (1996):

> The Tongue River Project is being proposed to alleviate dam safety concerns and protect downstream lives and property, to protect all existing water rights held in the Tongue River Reservoir, and to provide an additional 20,000 acre-feet of water to the Tribe. An additional requirement of the project involves the enhancement of fish and wildlife resources and habitat in the Tongue River Basin. All project goals are components of the Settlement Act, which ratified the Northern Cheyenne - Montana Water Rights Compact (Compact) entered into on June 11, 1991 by the Northern Cheyenne Tribe and the State of Montana

Significant issues were identified by the project sponsors relating to the modification of the dam to the Reservation. These include the effects on aquatic resources within the reservoir and river upstream and downstream of the reservoir, effects on the Decker coal mines adjacent to the reservoir, effects on Indian trust asset/Federal trust asset responsibility and potential effects of Tribal water development scenarios. Future alterations to upstream land use and hydrology may be significant, specifically with regard to water quality and sediment transport relationships governing the function of the reservoir and its discharge to the Reservation.

*b. Yellowtail Dam (Bighorn River)*

The Yellowtail Dam was completed in 1967 and stores about 1,375,000 acre-feet of water and discharges an average of 2,604,000 acre-feet per year. The upstream watershed encompasses 19,650 square miles, most of which are in Wyoming. (BOR, Project Data 1981). The Tribe's water right for 30,000 acre-feet of water specifies that the water will be made available from and measured at Yellowtail Dam. Because the Tribe is not required to use this water specifically on the Reservation, and to do so would require major infrastructural development for purposes of transbasin diversion, it is possible that this water will be used in exchange for more easily developable water or marketed. In either case, the quantity and quality of this water are subject to conditions upstream of Yellowtail Dam, i.e., production and storage, and below the dam, in the case of transport and "wheeling" of water.

*c. Cook and Rosebud Creek Basins*

No storage facilities presently exist within these drainages, however, the Tribe as part of its assessment of water resources has explored the possibility of developing storage facilities at various locations. HKM Consulting Engineers conducted studies of two alternatives for a dam within the Cook Creek drainage and a study of two alternatives within the Rosebud Creek drainage. (HKM, 1973; HKM, 1974). These studies were regarded as preliminary designs for purposes of evaluating options for future water resources development on the Reservation.

### 4. Water Quality.

The quality of surface water within the watersheds previously discussed is important to the Northern Cheyenne Reservation. Water quality concerns can be divided spatially according to the source watersheds. These are watersheds which generate flow on the Reservation, those which generate flow off the Reservation and transport water to it, and then the Bighorn River, which flows neither from nor to the Reservation, but to which the Tribe has water rights. Table 6-7, entitled Impaired Waterbodies in Area of Maximum CBM Potential, was modified from the Draft EIS to show only the watersheds pertinent to the Reservation. (BLM, 2002). It provides a general list of probable causes and sources of impairment for the each watershed listed.

**Table 6-7** - Impaired Water Bodies in the Area of Maximum CBM Potential, Relevant to the Reservation.

| **Watershed** | **Impaired Water Body** | **Probable Cause of Impairment** | **Probable Source of Impairment** |
|---|---|---|---|
| Upper Tongue | Hanging Woman Creek | Flow Alteration<br>Metals<br>Salinity/TDS/Chlorides | Agriculture<br>Irrigation<br>Natural Sources |
| Upper Tongue | Tongue River Reservoir | Nutrients<br>Organic Enrichment/DO<br>Suspended Solids | Agricultural<br>Municipal Point Sources |
| Upper Tongue | Upper Tongue River | Flow Alteration | Agriculture<br>Irrigation<br>Natural Sources |
| Upper Tongue | Tongue River (from Reservoir to. Hanging Woman Creek) | Flow Alteration | Agriculture<br>Flow Regulation/ Modification |
| Lower Tongue | Tongue River (from dam to mouth) | Flow Alteration<br>Metals<br>Other Organics<br>Salinity/TDS/Chlorides<br>Suspended Solids | Agriculture<br>Flow Regulation/ Modification<br>Irrigation<br>Natural Sources |
| Lower Tongue | Otter Creek | Metals<br>Other Habitat Alts<br>Salinity/TDS/Chloride<br>Suspended Solids | Agriculture<br>Highway/Road/ Bridge Construction<br>Land Development<br>Natural Sources |
| Rosebud | Rosebud Creek | Flow Alteration<br>Metals<br>Nutrients<br>Other Organics<br>Salinity/TDS/Chlorides<br>Suspended Solids | Agriculture<br>Irrigation<br>Natural Sources |

| Watershed | Impaired Water Body | Probable Cause of Impairment | Probable Source of Impairment |
|---|---|---|---|
| Lower Bighorn | Bighorn River (MT43P003-1) | Metals<br>Salinity/TDS/Chlorides<br>Suspended Solids<br>Thermal Modifications<br>pH<br>Other Inorganics<br>Siltation | Agriculture<br>Flow Regulation/ Modification<br>Natural Sources<br>Upstream Impoundments |
| Lower Bighorn | Bighorn River (MT43P005-1) | Metals<br>Salinity/TDS/Chlorides<br>Suspended Solids<br>Thermal Modifications<br>pH<br>Flow Alteration<br>Nutrients<br>Other Organics | Agriculture<br>Flow Regulation/ Modification<br>Natural Sources<br>Upstream Impoundments |
| Lower Bighorn | Bighorn River (Tullock Creek MT43P006-1) | Metals<br>Salinity/TDS/Chlorides<br>Suspended Solids<br>Nutrients<br>Other Inorganics | Agricultural Irrigation<br>Natural Sources |

(From 1996 Montana 303(d) List; BLM, 2002)

As can be seen, there are many sources of impairment with potential upstream effects on the Northern Cheyenne surface water quality. In addition, water quality on the Reservation has been heavily impacted by cattle grazing around springs and along streams, causing increasing sediment and nutrient levels. (Northern Cheyenne Tribe and BIA, 1999).

The magnitude of information relating to surface water quality is tremendous and to comprehensively address the broad topic of water quality as it relates to surface waters of the Northern Cheyenne Indian Reservation is beyond the scope of this section. The following represents an attempt to provide some additional water quality information for the Reservation which is pertinent to CBM development on and off the Reservation.

*a. Sodium Adsorption Ratio (SAR)*

The Draft EIS presents a table regarding surface water quality within the CBM development area of Montana. (BLM, 2002). It is entitled Surface Water Quality by Watersheds and provides a summary of water quality in terms of the parameter known as Sodium Adsorption Ratio (SAR). Information from this table was gleaned to focus on the watersheds that directly impact the Northern Cheyenne Reservation and Tribal water resources. (Table 6-8).

The SAR is commonly used as an indicator to predict the degree to which irrigation water tends to enter into cation-exchange reactions in soil. Higher values indicate a potential hazard of sodium replacing adsorbed calcium and magnesium. This condition

causes the breakdown of the structure of specific clay soils, which results in reduction of the soil's permeability, aeration and farmability. SAR is an important measure of irrigation water. (Hanson, 1999). Values for SAR are included in chemical analysis of irrigation water; however, the value is empirical and of otherwise limited geochemical significance. (Hem, 1992).

**Table 6-8 -** Average Base Flow, Average High Flow and corresponding SAR Values for Select Watersheds Relevant to the Northern Cheyenne Reservation. (Values from Preliminary CBM EIS, no period of record given)

| | | Average Base Flow | | Average High Flow | |
|---|---|---|---|---|---|
| **Location** | **USGS Gage #** | **CFS** | **SAR** | **CFS** | **SAR** |
| Upper Tongue (at state line) | 06306300 | 181 | NA | 1,724 | NA |
| Upper Tongue (at Tongue R. Dam near Decker | 0630750 | 175 | 1.1 | 1,467 | 0.4 |
| Lower Tongue (near Birney Day School) | 06307616 | 185 | 1.4 | 1,202 | 0.4 |
| Lower Tongue (near Ashland) | 06307830 | 206 | NA | 2,073 | NA |
| Lower Tongue | 06308500 | 194 | 2.4 | 1,305 | 0.6 |

SAR is not a complete indicator of water quality. The composition of water for irrigation purposes, or any other purpose, cannot be judged solely on the basis of it, or on the total concentration of ions. The determination of water quality includes a determination of individual ions present as well as suspended solids, biological contamination indicators, pH, presence of metals, temperature, organic hydrocarbons, etc.

*b. Existing Water Quality Data*

The USGS has collected water quality data at various streamflow gaging stations pertinent to the hydrology of the Reservation. Basic data were acquired from the USGS website and grouped according to sampling parameters provided. These data sets vary somewhat in the scope, intensity, and duration of sampling and parameters represented. For each parameter, data sets are comprised of discreet samplings, which are generally non-continuous in nature. Time periods vary from parameter to parameter. Available data are presented for each station as average, monthly summaries of measured values for each parameter monitored.

*i. Bighorn River*

Water quality data is monitored at various locations along the Bighorn River. The data represent that collected at USGS Station 6294000, near Hardin, Montana, for the parameter composite period 1969-1999. (Table 9; see Appendix D). Particular parameters of interest include specific conductance (SC) and SAR. Average SC ranges from 490 to 957 micro-siemans per centimeter, and average SAR ranges from 0.58 to 2.02.

*ii. Tongue River*

The waters of the Tongue River are also monitored at locations upstream of the Reservation including USGS Station 6306300, at the Wyoming/Montana state line (Table 10; see Appendix D). Previous studies indicated that several constituents exceeded safe drinking water standards, specifically sulfate, dissolved magnesium and total dissolved solids (TDS). The values cited by HKM were 500 ppm for sulfate, 50 ppm for magnesium and annual average of 543 ppm for TDS, for the year 1966. (HKM, 1972). A comparison of these figures, along with corresponding, long term average data from USGS State line gage are presented in Table 6-9.

**Table 6-9 -** Comparison of Previously Cited Water-Quality Parameters with long-term Average Figures, Tongue River at State line.

| Data Source | Range | Sulfate (mg/l) | Dissolved Magnesium (mg/l) | EC (uS/cm) | SAR | Boron (ug/l) |
|---|---|---|---|---|---|---|
| HKM (1972) | High | 500 | 50 | 1100 | 2.0 | 0.38 |
| | Low | | | 230 | | |
| USGS (1985-1999 average) | Mo. Average High | 180 | 45 | 699 | 0.67[1] | <1 |
| | Mo. Average Low | 30 | 10 | 299 | | |

[1] SAR = 0.67 reflects published USGS data for water year 1997, as parameter 00931 SAR is not included in data set available on USGS website.

The statements made in previous investigations regarding constituent concentrations, as reflected by averages of available data, and indicate, in general, that the Tongue River is not suitable for drinking (without treatment) but is suitable for irrigation, stock watering and recreation. Observations of water quality made downstream of Tongue River Dam may be obscured due to the tendency of the reservoir to dilute, modify chemically and delay in time, the transportation of contaminants to the Reservation. The complexity of Tongue River water quality at the Reservation, is further complicated by the episodic events characteristic of ephemeral drainages located upstream of the Reservation. These drainages will tend to transport potential pollutants resulting from high intensity, short duration storms, which will generate small or broad scale flooding and possibly retention pond failures. Monitoring of flows and water quality parameters like specific conductivity, at the various points of principal drainages to the Tongue River will likely become more important in the future.

*iii. Select Tongue River Tributaries*

Several Tongue River tributaries near the Reservation have been monitored for water quality constituents. These include Otter Creek, Hanging Woman Creek, and Prairie Dog Creek. (Tables 12 through 14; see Appendix D). No water quality data were located with regard to Cook Creek. Data that were available represent monthly averages. Waters of these Tongue River tributaries have generally higher constituent concentrations than that of the Tongue River.

The USGS has studied Hanging Woman and Upper Otter Creek to estimate effects of surface coal mining on hydrology and water quality. With regard to Otter Creek, the USGS noted that water samples from Otter Creek were similar to water samples from wells completed in the alluvium. The samples contained large concentrations of sodium, magnesium, and sulfate. Dissolved-solids concentrations in the Otter Creek samples were 3,600 to 4,080 mg/L. (McClymonds, 1988).

With regard to Hanging Woman Creek, near Birney, Montana, the USGS noted that dissolved-solids concentrations vary greatly with location and with magnitude of discharge. In general, concentrations decrease downstream and also decrease during large increases in streamflow. The largest concentration of dissolved solids (14,000 mg/L) was measured at station 063075450 near the Montana-Wyoming State line on June 8, 1983. Large concentrations of dissolved solids are common during the summer, when streamflow is small or the water becomes ponded or stagnant. Salt deposits accumulate along the streambanks during extended periods of low streamflow or stagnant water. (Cannon, 1989).

At station 06307600 near Birney and the mouth of Hanging Woman Creek, dissolved-solids concentrations were substantially smaller than at upstream stations. Analysis of 117 water samples collected at the station between October 1974 and November 1987 at discharges that ranged from 0.01 to 360 ft 3/sec showed that dissolved-solids concentrations ranged from 180 to 3,200 mg/L, with a median concentration of 1,800 mg/L. (Cannon, 1989).

The downstream decrease in dissolved-solids concentrations can be explained by the increase in streamflow derived from shallow groundwater discharge. The downstream part of the Hanging Woman Creek basin has a much greater area of clinker beds than the upstream part and discharges more groundwater having smaller concentration of dissolved solids. (Cannon, 1989).

Near Birney, magnesium, sodium and sulfate concentrations were 46-230 mg/L, 29-500 mg/L and 98 mg/L. It was noted that sodium concentrations in the upstream part of Hanging Woman Creek near the State line (station 06307540) were as large as 2,700 mg/L in June 1983. The SAR ranged from 1 during high streamflow near Birney to 17 near the State line. The SAR of water in Hanging Woman Creek indicates a medium to high salinity hazard for irrigation of crops (U.S. Salinity Laboratory Staff, 1954) except during periods of high streamflow, when dissolved-solids and sodium concentrations are smaller.

Sulfate was the dominant anion in all samples from Hanging Woman Creek. Sulfate concentrations ranged from 98 mg/L during high streamflow near Birney to 9,900 mg/L at the State line. Sulfate concentrations decrease downstream, similar to concentrations of other major ions. (Cannon, 1989).

These observations reflect mostly natural hydrologic and geohydrologic conditions, where the stream water quality is function of natural runoff and groundwater discharge and specifically the contributions of higher quality water emanating from the clinker deposits. Without such contributions, water quality generally becomes worse with flow distance and decreasing flow. The storage of high TDS water in constructed impoundments within the watershed may alter the loading of constituents to the Tongue River, if such stored waters are in some manner mobilized into and through the streamcourse.

*iv. Rosebud Creek*

Rosebud Creek water quality parameters are presented in Tables 15 and 16 (Appendix D) corresponding to USGS gage 06295100 near Kirby, Montana and 06295250 near Colstrip, Montana. Specific conductivity, which is a surrogate indicator of total dissolved solids ranges from 955 to 1,340 uS/cm at Kirby and 1,073 to 1,625 uS/cm at Colstrip. On this basis, total dissolved solids increases with flow miles. High specific conductivity or TDS values concur with low flow. Monthly averaged data from Colstrip indicate that concentrations of magnesium and sulfate range from 78-116 mg/L and 280-482 mg/L respectively. SAR values range from 1.2-1.7 at Colstrip.

## B. Groundwater Resources.

As described earlier, the Northern Cheyenne Indian Reservation lies in the northwestern part of the Powder River Basin in the southeastern part of Montana and encompasses potions of Rosebud and Bighorn Counties. Altitudes within the Reservation range from 2,920 feet north of Ashland to about 4,730 feet near Bull Elk Lookout Tower southeast of Busby. The topography is rough with long narrow ridges, extensive hillsides and generally narrow flood plains. The central portion of the Reservation is an upland plateau, which rises 800 to 1,000 feet above the surrounding terrain. This upland plateau has been deeply dissected by the Tongue River, Rosebud Creek and their tributaries. (HKM, 1983).

### 1. Geologic Units and Associated Aquifers.

Formations of importance to the groundwater resources of the Reservation include the Madison Group of Mississippian age; the Fox Hills Sandstone and Hell Creek Formation of Cretaceous age; the Fort Union Formation of Tertiary age and the valley fill-alluvium of Quaternary age. Information pertaining to the groundwater resources on the Reservation was obtained primarily from HKM Associates, Shallow Groundwater Study (1983) unless otherwise cited.

*a. Madison Group*

The Madison Group is divided into the Lodgepole Limestone at the base, the Mission Canyon Limestone and the Charles Formation at the top. The Madison Group is estimated to average around 1,100 feet thick within the Reservation and the depth to the top is estimated to range between 7,200 and 9,100 feet below land surface. The aquifer contained within the Madison Group reportedly consists of extensive limestone and dolomite with shale, evaporate, and cherty zones. (NCRP, 1981). Yields from Madison wells in the area range from 94 gpm immediately NW of the Reservation to a reported 2,382 gpm from a flowing well approximately 90 miles NW of the Reservation.

Porosity and permeability in the Madison aquifer are mainly associated with oolitic to fragmental limestone and with coarsely crystalline dolomite in the lower part. Solution and collapse breccias occur in the outcrops off the Reservation; the extent of these features in the subsurface within the Reservation is unknown.

*b. Fox Hills Sandstone*

The Fox Hills Sandstone, in the central Powder River Basin east of the Reservation, is a sequence of marine and continental sandstone and shale 20 to 200 feet thick. Limited information available from oil and gas test holes on the Reservation indicates thickness of this unit to range from 65 to 760 feet. Depth to the top of the Fox Hills in the Reservation is estimated to range between 2,200 and 3,500 feet.

The most extensively used aquifer in the Central Powder River Basin is called the Fox Hills-Lower Hell Creek aquifer and it consists of the Fox Hills Sandstone and the overlying lower part of the Hell Creek Formation. Well yields from the Fox Hills-Lower Hell Creek aquifer range from 0.5 to 20 gpm and commonly are about 5 gpm. Yields of as much as 200 gpm to industrial wells have been reported. (Slagle, 1985).

*c. Hell Creek Formation*

The Hell Creek Formation consists of sandstones, interbedded shales and siltstones. Available data indicates this unit underlies the entire Reservation with a thickness of between 600 and 650 feet. Depth to the top of the Hell Creek formation within the Reservation is estimated to be greater than 600 feet.

Only one well is known to be completed in the Hell Creek formation near the Reservation. It was drilled in 1959 for Saint Labre Mission to a total depth of 980 feet. At the time the well was constructed, it was under artesian pressure and flowed at the land surface at a rate of 60 gpm.

*d. Fort Union Formation*

The Fort Union Formation consists of the Tullock, Lebo Shale, and Tongue River members. The total thickness of this formation within the Reservation is estimated to range from 1,800 to 2,200 feet. The formation dips to the southeast at 1 to 2 degrees regionally.

*i. Tullock Member*

The Tullock member is estimated to range between 100 and 250 feet thick on the Reservation and consists of sandstone, coal and shale beds. This unit is not a known source of water on the Reservation. Yields to wells completed off the Reservation in the Tullock Member range from about 0.3 to 40 gpm and generally are about 15 gpm. (Slagle, 1985).

*ii. Lebo Shale Member*

The Lebo Shale member consists of dark shale and reportedly contains some lignite beds but no coal. The thickness of this unit on the Reservation is estimated to range between 100 and 300 feet. It is not a known source of water.

*iii. Tongue River Member*

The Tongue River Member of the Fort Union Formation is the major source of water withdrawn from wells in the northern Powder River Basin. (Slagle, 1985). It is the most reliable and shallow aquifer underlying most of the area, including the Northern Cheyenne Reservation. HKM Associates (1983) have divided this member into lower and upper aquifers.

There are over 100 springs on the Northern Cheyenne Reservation. (Figure 6-2). Many of these springs emanate from the base of a clinker-shale contact, very commonly in the Tongue River Member of the Fort Union Formation. The springs may be quite vulnerable to the effects of regional aquifer drawdown. Depending on the geologic location of the spring, yield can range from 1 to 92 gpm. (NCRP, 1981).

1. Lower Tongue River Aquifer

The Lower Tongue River aquifer consists of the sandstone, siltstone, shale, coal and clinker beds from the base of the Robinson coal seam to the shale beneath the Knobloch coal seam. The aquifer is generally around 500 feet thick, except in the major stream valleys where erosion has reduced the total thickness to between 300 and 450 feet thick. Drill hole data indicates beds of permeable sandstone and shale are discontinuous and occur primarily as lenses grading from shale to siltstones.

Several wells are known to be completed in the lower Tongue River aquifer. Most of these domestic wells were completed in sandstone and yield between 8 and 20 gpm. Wells in Muddy Cluster and Busby finished in the sandstone reportedly yield 18 and 50 gpm, respectively.

2. Upper Tongue River Aquifer

The Tongue River Member is Tertiary in age and crops out at the surface over much of the Reservation. The Upper Tongue River aquifer consists of the sandstone and clinker beds within the Knobloch, Wall and Anderson systems.

*Knobloch System.* This unit consists of sandstone, siltstone, shale, coal and clinker. The Knobloch system ranges from 0 to 366 feet in thickness. Depth to the top of the unit would generally be less than 1,100 feet depending on location on the Reservation. Many wells and springs obtain groundwater from this system. Yields of wells completed in the sandstone generally range between 8 and 10 gpm. Wells completed in the Knobloch clinker yield as much as 50 gpm. Springs associated with sandstone and coal outcrops of the Knobloch generally flow less than 3 gpm.

*Wall System.* The Wall system consists of sandstone, siltstone, shale, coal and clinker. It ranges in thickness from 0 to 790 feet. Beds of permeable sandstone are discontinuous and occur primarily as lenses between shale and siltstone layers. Depth to the top of the unit would generally be less than 300 feet depending on location on the Reservation. The Wall coal seam and its related clinker form the thickest most continuous unit of this system, ranging from 20-40 feet. The Canyon coal seam, within the Wall system, also forms a relatively thick and continuous unit (20 to 30 feet).

Several wells and springs derive water from the Wall system. Well yield ranges from 10 to 15 gpm. Springs flow from sandstone, siltstone and clinker units and vary from 1 to 25 gpm within the Reservation. (NRCP, 1981).

*Anderson System.* This system consists of fine sandstone, siltstone, shale, coal and clinker ranging in thickness from 0 to 300 feet. The Anderson coal seam and its related clinker deposits form the thickest single unit within this system. Thickness of the Anderson coal varies from 30 to 60 feet but thins to the west. Massive clinker related to the burning of the Anderson and small upper coal seams is reported to vary from 100 to 200 feet in the central and northern portions of the Reservation.

Several wells and springs are known to derive water from the Anderson aquifer system. No production data is available as all wells completed before 1977 were monitoring wells. Springs associated with

sandstone and siltstone units above the Anderson coal seam generally yield less than 1 gpm within the Reservation. (NRCP, 1981).

*e. Valley Fill-Alluvium*

Valley fill-alluvium is found underlying and bordering the principal drainages within the Reservation. These deposits include the Rosebud Creek, Muddy Creek, Lame Deer Creek and Tongue River alluvium.

*i. Rosebud Creek Alluvium*

The Rosebud Creek alluvium consists of clay, silt, sand, gravel and clinker fragments. Silts and clays are usually found as thin beds separating sand and gravel deposits. According to driller's logs, the Rosebud Creek alluvium ranges in thickness from 6 to 110 feet, with an average thickness of 52 feet.

An aquifer test performed in 1978 indicated an average transmissivity of 6243 $ft^2/d$ for a saturated thickness of approximately 76 feet. This value is considered to be representative of the valley fill alluvium immediately adjacent to Rosebud Creek between the southern Reservation boundary and Busby. For wells completed in the Rosebud Creek alluvium, yield ranges between 6 and 20 gpm.

*ii. Muddy Creek Alluvium*

The Muddy Creek alluvium consists of a mixture of silt, sand, gravel, and clinker fragments. Based on driller's logs, the thickness of these deposits range from 0 to 112 feet and average 52 feet thick. The average saturated thickness is 30 feet. Assuming the deposits are similar to the Rosebud Creek alluvium, a transmissivity of 2,463 $ft^2/d$ is calculated. Several wells known to be completed in the Muddy Creek alluvium yield between 10 and 15 gpm for domestic supply.

*iii. Lame Deer Creek Alluvium*

The Lame Deer Creek alluvium consists of silt, sand, and relatively thick gravel and clinker wash as compared to that of Rosebud and Muddy Creek deposits. Driller's logs indicate that the thickness of this deposit ranges from 12 to 63 feet. Domestic wells completed in the Lame Deer Creek alluvium yield between 6 and 15 gpm.

*iv. Tongue River Alluvium*

The Tongue River alluvium consists of sand and gravel-sized clinker fragments derived from the Tongue River member of the Fort Union formation. The thickness of this deposit ranges from 34 to 100 feet and averages 66 feet.

An aquifer test was performed near Ashland, Montana in October 1978. The results of that test indicated an average transmissivity of 14,532 $ft^2$/day for a saturated thickness of approximately 55 feet. Many wells on the Reservation are completed in the Tongue River alluvium. Wells yield between 50 and 400 gpm.

### 2. Water Quality

A thorough evaluation of groundwater quality was performed by the Northern Cheyenne Research Project from 1973 through 1977, and published by HKM in 1983. The following descriptions are based on the data collected during that study period. The majority of water quality data on the Reservation exists for the Fort Union and alluvial aquifers.

*a. Fort Union Formation – Tongue River Member*

Samples obtained from wells indicated water in these geologic units to be a mixed type with this dominant ions being sodium, magnesium, calcium, bicarbonate and sulfate. Total dissolved solids (TDS) concentration generally range from 232 to 3,774 mg/l in wells tapping sandstone, coal and clinker units. Water ranges from soft to very hard with calcium carbonate levels between 14 to 1,468 mg/l. Fluoride concentrations range from 0.1 to 9.1 mg/l and sulfate concentrations range from 0 to 2,119 mg/l. Adjusted SAR values for water samples obtained from the sandstone units of the Tongue River member of the Fort Union formation ranged from 0 to 53. Water samples from the coal beds of the Fort Union had adjusted SAR values ranging from 2.6 to 101.

Springs contained very hard water with calcium carbonate concentrations between 190 to 950 mg/l. Sulfate and fluoride concentrations ranged from 8.0 to 337 mg/l and 0.27 to 12.0 mg/l, respectively. The adjusted SAR ranged from 0.5 to 50.8.

Groundwater from sandstone and coal aquifers of the Tongue River member is generally suitable to serve as a drinking water source; however, several samples from wells obtaining water from the coals did exceed the Primary Drinking Water Standards for chromium and fluoride. Water from the Tongue River aquifers is generally quite mineralized and not aesthetically pleasing. This water is generally undesirable for irrigation due to salinity problems; however, it is acceptable for livestock use.

*b. Valley Fill - Alluvium*

Water-quality for the valley fill-alluvium on the Reservation appears to be a mixed-type, with the dominant ions being calcium, magnesium, sodium, bicarbonate and sulfate. A range of water-quality values in the alluvial systems is presented in Table 6-10.

**Table 6-10** – Water-Quality of the Alluvium on the Northern Cheyenne Reservation

| Constituent | Rosebud Creek | Muddy Creek | Lame Deer Creek | Tongue River |
|---|---|---|---|---|
| TDS (mg/l) | 374 – 2048 | 1082 - 1574 | 558 - 1144 | 527 - 3277 |
| $CaCO_3$ (mg/l) | 140 – 1225 | 664 - 955 | 450 - 626 | 35 - 946 |
| Sulfate (mg/l) | 67 – 1370 | 313 - 731 | 119 - 361 | 0 – 1893 |
| Nitrate (mg/l) | 0 - 4.0 | 0 - 1.0 | 1.0 – 4.3 | 0.1 - 6.2 |
| Fluoride (mg/l) | 0 - 1.3 | 0.5 - 1.5 | 0.8 - 2.0 | 0.3 - 6.4 |
| Adjusted SAR | 0 – 34 | 5.2 - 6.0 | 5.2 – 6.0 | 4.3 - 51 |
| No. wells tested | 17 | 5 samples | 4 | 12 |

Data published in HKM (1983) from NCRP data collected from 1973-1977.

Groundwater from the alluvium is generally suitable for drinking water with respect to the Primary Drinking Water Standards, although several samples taken from wells completed in the alluvium of Rosebud, Muddy, Lame Deer Creeks and the Tongue River, equaled or exceeded the Primary Standards for cadmium. (HKM, 1983). One sample from a well completed in the Rosebud Creek alluvium exceeded the limits for chromium and lead. (HKM, 1983).

The alluvial groundwater is quite mineralized with concentrations of TDS, sulfate, iron and manganese that often exceed Secondary Drinking Water Standards. Exceeding secondary standards does not represent a health hazard, but rather makes the water less desirable as a drinking water source for aesthetic reasons.

The alluvial groundwater would probably be suitable for irrigation provided tolerant crops were used and special irrigation practices were instituted to prevent salinity and permeability problems. (HKM, 1983). The water is acceptable for livestock use.

### 3. Groundwater Movement.

A great majority of data existing on the Reservation is from the shallow alluvial groundwater system. Although deeper, better quality water may exist on the Reservation, money is generally not available to explore these potential resources representing a real vulnerability of the Tribe when it comes to obtaining good quality and reliable drinking water.

According to Slagle (1985), two general flow patterns are present in the northern Powder River Basin. An upper flow pattern, controlled by topography, occurs in aquifers at depths of less than about 200 feet. A lower flow pattern, characterized by regional flow generally northward toward the Yellowstone River and significant flow toward the Powder and Tongue Rivers, is present in aquifers at depths of more than about 200 feet.

*a. Deep Groundwater System*

Very little data exists within the deep groundwater system to determine flow direction on the Reservation. The USGS prepared a potentiometric surface map of the Madison Group showing recharge in the Bighorn Mountains and groundwater movement from the southwest to the northeast and north passing beneath the Reservation. (NCRP, 1981).

*b. Shallow Groundwater System*

Potentiometric surface maps (Hopkins, 1973; NCRP, 1981; Slagle, 1985) of the shallow groundwater system within the Reservation show that lithology, topography and the two major drainages (Tongue River and Rosebud Creek) appear to influence the movement of shallow groundwater within the Reservation. Groundwater generally moves to the west and northwest to Rosebud Creek and southeast to east to the Tongue River from the highlands of the central Reservation. Along the western edge of the Reservation, groundwater flows generally east from the Wolf and Rosebud Mountains and southeast from the Little Wolf Mountains to Rosebud Creek.

Water is recharged to the shallow system in high plateau areas and to outcrops of clinker, sandstone, and alluvium by direct precipitation and water discharges to the major streams. (NCRP, 1981). Underlying aquifers are sometimes recharged by the downward leakage of the upper aquifer systems.

Thick continuous coal seams of the Fort Union Formation transmit water laterally toward outcrop areas. Outcrop areas of aquifers in the central potion of the Reservation are usually discharge points if sufficient water is available. (NCRP, 1981).

### 4. Quantity of Groundwater

The saturated thickness, specific yield, and areal extent of an aquifer are used to determine the quantity of groundwater in storage. With the available data on the Reservation, groundwater storage was only calculated for the alluvial aquifer systems. The total available groundwater in storage within the alluvial sediments of the Reservation is approximately 115,500 acre-feet. (Table 6-11).

**Table 6-11** – Volume of Water Stored in Alluvial Aquifer Systems on the Reservation

| Alluvial System | Avg. Thickness (ft) | Specific Yield | Area (acres) | Volume (acre-ft) |
|---|---|---|---|---|
| Rosebud | 43 | 0.12 | 11,224 | 57,900 |
| Muddy | 30 | 0.12 | 1,374 | 4,900 |
| Lame Deer | 35 | 0.12 | 1,828 | 7,700 |
| Tongue | 36 | 0.15 | 8,337 | 45,000 |
| | | | **Total** | **115,500** |

Data obtained from HKM (1983)

### 5. Cultural Significance of Groundwater.

As discussed in more detail in Chapter 7, The Northern Cheyenne people believe that all things in the universe have spirits, including groundwater and associated springs. The Northern Cheyenne recognize the spiritual qualities of groundwater. There are special prayers for digging wells. Groundwater represents the quiet nature of the earth, and it should not be disturbed. Springs are the homes of the spirits. Offerings are commonly left at springs today. (BLM, 1989).

## C. Water Rights.

The water rights of the Northern Cheyenne Tribe are set forth in the Northern Cheyenne-Montana Compact, which represents a statement of the federally reserved water right held by the Tribe. The Reserved Water Rights Compact Commission (RWRCC) of Montana describes Federal Reserved Water Rights as follows:

### 1. Federal Reserved Water Right.

A federal reserved water right is a right to water that was created when Congress or the President of the United States reserved land out of public domain. The U.S. Supreme Court has ruled that enough water be reserved to meet the purposes for which the reserved lands were designated. The date that the land was withdrawn and the reservation created is the priority date of a federal reserved water right. Reserved water rights for Indian reservations, for instance, go back to the 1800s. Federal reserved water rights do not have the same restrictions placed on them as on state appropriative water right. For example, a notice of appropriation or beneficial use is not required to maintain a federal reserved right, and it is not lost due to non-use.

The Tribe's reserved water right addresses three sources of water, the Tongue River, the Bighorn River and Rosebud Creek. The Compact entitles the Tribe to a priority date of October 1, 1884. This right provides for:

- The diversion of 1,800 acre-feet per year, or the amount necessary to irrigate 600 acres, from Rosebud Creek.

- The diversion of 30,000 acre-feet per year from the Bighorn Lake at Yellowtail Dam for any beneficial use.

- The diversion of 32,500 acre-feet from the Tongue River for any beneficial use.

- An additional 19,530 acre-feet from Rosebud Creek, for any beneficial use subject to the constraint that diversion and use do not adversely affect other water right holders of priority June 30, 1973 and earlier.

- The extraction of alluvial groundwater by means of wells of less than 100 gallon per minute pumping capacity, exclusive of other water rights.

## 2. History of Compact

The USBR provides a good summary of the history of water rights with regard to the Northern Cheyenne. It is restated here from the Tongue River Basin Project Final Environmental Impact Statement, March 1996.

> In 1913, the state court of Montana initiated a proceeding to adjudicate water rights on Tongue River. In this proceeding, the federal government did not fully satisfy the Northern Cheyenne Tribe's water Winters rights claims to water in the Tongue River. Instead, the United States asserted a claim on behalf of the Tribe only for the amount of water used by the Tribe at that time. In the Miles City Decree of 1914 (the Decree), the Tribe was awarded only 30 cubic feet per second (cfs) of water out of an available 425 cfs. The Decree established a priority date of 1909 for the Northern Cheyenne water claim: the next to last priority awarded in the Decree. The Tribe's water right as set forth in the Decree was insufficient to irrigate the Tribe's agricultural lands at the time and the late priority date established a high probability that the Tribe would be out of water before the irrigation season began.
>
> The Tribe has asserted that the failure to pursue the Tribe's Winters rights claims constituted a breach of the federal trust responsibility. In 1975, the Tribe filed an action in U.S. District Court to determine its water rights. The Untied States also filed suit on behalf of the Tribe. In 1979, the State of Montana initiated proceedings for a general stream adjudication, which included the claims of the Tribe. In that same year, the estate established the Montana Reserved Water Rights Compact Commission to negotiate a water rights settlement with the tribes of Montana. Negotiations with the Tribe began in 1980. Several years of negotiations yielded the Northern Cheyenne-Montana Water Rights Compact (the Compact). The Tribe formally approved the Compact on May 20, 1991 with Tribal Resolution #144. The Compact was ratified by the Montana State Legislature on June 11, 1991, and was re-ratified on December 16, 1993 by the 53rd Legislature Special Session.

On September 30, 1992, the federal government ratified the Compact via "The Northern Cheyenne Indian Reserved Water Rights Settlement Act of 1992" (Pub.L. 102-374, 106 Stat. 1186) (Settlement Act). The purposes of the Settlement Act of 1992 are:

> To achieve a fair, equitable, and final settlement of all claims to Federal reserved water rights in the State of Montana of the Northern Cheyenne Tribe and its members and allottees and the United States on behalf of the Northern Cheyenne Tribe and its members and allottees. To approve, ratify and confirm the Water Rights Compact entered into by the Northern Cheyenne Tribe and the State of Montana on June 11, 1991. To direct the Secretary of the Interior to enter into a cooperative agreement with the State

of Montana for the planning, environmental compliance, design, and construction of the Tongue River Dam Project (P.L. 102-374, 106 Stat, 1186, Section 3(8)) in order to: implement the Compact's settlement of the Tribe's reserved water rights claims in the Tongue River Basin, protect existing Tribal contract water rights in the Tongue River Basin: provide [up to as per the Compact] 20,000 acre-feet per year of additional storage water for allocation to the Tribe, and allow the State to implement its responsibilities to correct identified Tongue River Dam safety inadequacies. To provide for the conservation and development of fish and wildlife resources in the Tongue River Basin. To provide for the enhancement of fish and wildlife habitat in the Tongue River Basin. To authorize certain modifications to the purposes and operation of the Bighorn Reservoir in order to implement the Compact's settlement of the Tribe's reserved water rights claims. To authorize the Secretary of the Interior to take such other actions as are necessary to implement the Compact.

#### 3. Northern Cheyenne Water Code

As a result of the above process, the Tribe is now in a position to meaningfully undertake development of their resources and has set forth and adopted water management policies and procedures. These have been formalized in the Northern Cheyenne Water Code (Amended Dec 18, 2000).

### D. Tribal Water Policy and Management

#### 1. Northern Cheyenne Water Code

The Northern Cheyenne Water Code sets the regulatory framework for the management of Tribal water resources on the Reservation. The purpose of the Water Code is to preserve and protect the quantity and quality of Tribal water resources through wise use, administration, management, and enforcement. This includes, but is not limited to, permitting and prioritizing tribal water use, long-term planning to ensure the sustainability of resources, encouraging conservation practices, and protecting traditional, religious and cultural uses of water.

*a. Tribal Water Resources Board and Administrator*

The administration of the Water Code will be the responsibility of a Tribal Water Administrator (TWA) and a Tribal Water Resources Board (Water Board). The Tribal Water Board is responsible for adopting new rules and regulations, approving or disapproving permits, reporting to the Tribal Council on relevant water-related issues, declaring critical management areas and water supply conditions, establishing and maintaining a technical staff to administer and enforce the Code, and developing recommendations for long-term funding sources to support tribal water management.

The Tribal Water Administrator (TWA) issues citations and initiates enforcement proceedings for violations of the Code. The TWA administers water rights, monitors and enforces water use through inspections, responds to emergency situations, collects data and researches development possibilities, and conducts educational programs. Recommendations are made to the Water Board on critical management areas and methods for improving water use and efficiency. The TWA develops and submits an annual budget and report to the Water Board.

*b. Water Management*

The Water Code sets forth the primary physical, hydrologic and engineering principles guiding the management of surface and groundwater resources on the Reservation. These procedures are required to effectively manage, fully utilize and protect the water rights of the Northern Cheyenne Tribe, and to assure compliance with applicable laws and requirements of the Northern Cheyenne Montana Compact of 1991 and the Northern Cheyenne Water Rights Settlement Act of 1992.

The Water Board will adopt a Comprehensive Water Management Plan at least every five years to guide water resource decisions, permitting and management. Surface water and groundwater is evaluated, and no later than March 1 of each year, the condition of these resources is declared. Water allocation procedures for both surface and groundwater are outlined in this section for use during drought conditions.

*c. Permitting*

A water permit is required to divert or undertake any activity affecting or involving tribal water. This includes water diversions, discharge, injection, transfers, surface water alterations, groundwater recharge, storage impoundments, or hydropower generation. The Code clearly identifies the application process outlining the procedures, hearings, and resolution of water disputes. The Water Board will preside over all hearings. The Tribal Court will enforce subpoenas issued by the Water Board.

*d. Enforcement*

Prohibited acts and penalties are clearly outlined in the Water Code. Any person who commits prohibited acts shall be subject to civil proceedings before the Water Board on citation by the Tribal Water Administrator. All decisions of the Water Board shall be appealable directly and exclusively to the Tribal Courts.

*e. Summary*

The Northern Cheyenne Water Code contains the provisions and guidelines to effectively manage the water resources of the Reservation, however, with the fairly recent approval of the Water Code, the Tribal Water Resources Board has not yet been established. Currently, no permitting process or accounting for water resources exists on the Reservation. Once underway, the Water Code will empower the Tribe by enabling them to control and protect the water resources on the Reservation.

### 2. Northern Cheyenne Tribe Draft Surface Water Quality Standards.

*a. Introduction*

A water quality standard defines the water quality goals for a water body, or portion thereof, by designating the use or uses to be made of the water, by setting criteria necessary to protect the uses, and by protecting water quality through antidegradation provisions. The Tribe is in the process of adopting these standards to protect public health and welfare, enhance the quality of water and serve the purposes of the Federal Clean Water Act._

Currently, the Northern Cheyenne Tribe's Draft Surface Water Quality Standards have been submitted to the EPA and the public review process is near completion. In addition, the Tribe's application under Section 518 of the Clean Water Act for Treatment as a State for the purposes of implementing the Clean Water Act's water quality standards program is still pending before the EPA. The Tribe's Treatment as a State application and water quality standards are vital in the Tribe's water quality protection program and aid in evaluating potential impacts on water quality from a broad range of causes and sources. A primary purpose of the water quality standards is to guide efforts to monitor and assess surface water quality within the Reservation. Any regulatory pollution controls established by the Tribe or the Federal Government must be developed to ensure a level of water quality that will satisfy these water quality standards.

Surface water quality standards are adopted to establish maximum allowable levels or concentrations of pollutants and provide a basis for protecting water quality that is presently better than standards required for surface water quality. They serve to establish a basis for limiting the introduction of pollutants, which could affect existing or designated uses of Reservation surface waters. The following surface water characteristics and policies are described in the Draft Water Quality Standards:

*b. Beneficial Uses*

Beneficial use classifications are designated to all surface waters of the Reservation in order to achieve national "fishable and swimmable" goals. Narrative water quality criteria and sampling methods are described along with the Tribe's biological and radiological surface water standards.

*c. Antidegradation Policy*

The Tribe's antidegradation policy is consistent with the federal antidegradation policy found in EPA's water quality standards regulation. The purpose of the policy is to protect existing water quality where the quality of the water is better than required to support the designated uses.

*d. Mixing Zone and Dilution Policy*

The mixing zone and dilution policy describes how dilution and mixing of point source discharges within receiving waters will be addressed in developing discharge limitations for point source discharges. Compliance requirements and 401 Certification procedures are also described. The requirements for standards implementation are outlined

Once approved and adopted by EPA, the Tribe's standards program will have the same legal standing as those adopted by states. The federal government will be responsible for the enforcement of the standards. EPA Region VIII will have the responsibility of enforcing requirements applicable to point source discharges, including those permit requirements that are based on the Tribe's water quality standards.

*e. SAR and EC*

The Tribe is especially concerned about salinity and its impacts on riparian areas and irrigated lands. The Tribe has developed numeric criteria for the Sodium Adsorption Ratio (SAR) and Electrical Conductivity (EC) of waters of the Reservation to address these concerns. The proposed numeric standards for EC and SAR are presented in Table 6-12.

The rationale behind the numeric criteria for SAR is based on James Bauder's final report, *Recommended in-stream standards, thresholds and criteria for irrigation or water spreading to soils of alluvial channels, ephemeral streams, flood plains, and potentially irrigable parcels of land within the boundaries of the Northern Cheyenne Reservation*. (2001).

**Table 6-12. Revised Numeric Standards for EC and SAR and Indicator Values for TDS Applicable to the Mainstems of the Tongue River and Rosebud Creek and their Tributaries**

(In response and consideration of comments, concerns, objections received from various parties, the following modifications have been incorporated into the proposed surface water standards for EC and SAR of the Northern Cheyenne Reservation.)

| | Electrical[1] Conductivity (EC) dS/m | Sodium[2] Adsorption Ratio (SAR) | Total[3] Dissolved Solids (TDS) mg/L |
|---|---|---|---|
| Southern Boundary | | | |
| Irrigation period average[4] | 1.0 | -- | 660 |
| Non-irrigation period average[5] | 2.0 | 2.0 | 1320 |
| Northern Boundary | | | |
| Irrigation period average | 1.5 | -- | 990 |
| Non-irrigation period average | 2.0 | 3.0 | 1320 |
| Tributaries | | | |
| Irrigation period average | 1.5 | -- | 990 |
| Non-irrigation period average | 2.0 | 3.0 | 1320 |

1 The EC values are numerical water quality standards. EC is an expression of salinity as electrical conductance reported in deciSiemens per meter at 25 degrees C (dS/m) or in units of millimhos per centimeter (mmho/cm).

2 The SAR values are numerical water quality standards. Sodium adsorption ratio (SAR) is an expression of the concentration of sodium relative to the sum of concentrations of calcium and magnesium in water.

3 The TDS values are indicator values and are not water quality standards. TDS is an expression of salinity as total dissolved solids in mg/L. The TDS values will be used to monitor conditions and trends in Tribal waters. If a TDS indicator value is exceeded, the Tribe will evaluate the cause and, where appropriate, make necessary adjustments to the EC water quality standard(s). Any change to the EC standard will be made through the Tribe's water quality standards-setting process.

4 An "irrigation period average" is a 30-day average applicable during the period of active irrigation or water spreading, defined by the Tribe as April 1st through November 15th annually.

5 A "non-irrigation period average" is a 30-day average applicable during the non-irrigation season, November 16th - March 31st annually.

The EPA does not currently have any numeric criteria for these pollutants because the level tolerated by soils varies greatly based upon soil type. The State of Montana is currently developing numeric criteria for these constituents. The adoption of numeric criteria for SAR and EC will greatly assist agencies issuing permits to protect the Tribe's resources.

## III. Uses of Tribal Water Resources.

Historically, the use of Tribal water resources has been limited to uses typical of small communities within southeastern Montana. These being relatively small amounts of water required for common and practical water uses associated with community/domestic and municipal requirements, stock watering, limited irrigation and forestry related uses such as those relating forest and range fire fighting and a small amount associated with the Tribally owned saw mill. Much of this water is derived from wells and springs; however, some diversion of water from the Tongue River and Rosebud Creek is undertaken for irrigation of lands along those stream courses. Development and use of water in the past have been restricted due to unsettled water rights and the limited economic capability of the Tribe to develop resources in general.

Because of the settlement of water rights and ratification of the Compact, it is expected that future use of Tribal water resources will likely accelerate. The Bureau of Reclamation (1997) stated that "The increased water proved by the [Tongue River] project is a result of negotiations between the Tribe and the State of Montana. According to provisions of the Settlement Act, the Tribe, State of Montana, federal government, U.S. Congress and the President of the United States agreed formally that the tribe is free to use its Compact water for any purpose it chooses. Furthermore, the Tribe is free to change its use of Compact water as it wishes and at any time. The Tribe has identified its present and reasonably foreseeable use of Compact water as fish, wildlife, and recreation purposes in the reservoir and downstream."

### A. Agriculture.

The unrealized potential for irrigation development on the Reservation was a central point in the quantification and justification of Tribal water claims. Among the future uses of water available to the Tribe, irrigation may have the greatest potential demand.

#### 1. Agricultural Land.

The Northern Cheyenne inhabited lands surrounding the Powder River Basin along with the Sioux and Crow Indians prior to 1860. (Weist, 1977). Land within the Tongue River Basin began to be settled by non-Indians after the establishment of Fort Custer and Fort Keogh in 1877. It was not until the arrival of the Union Pacific Railroad, in 1882, that significant tillage based agriculture became practiced in the region, most of which was dryland farming. (Northern Cheyenne Agency, 1964)

*a. Historical Irrigation*

The U.S. Bureau of Reclamation surveyed the Tongue River Basin and produced a report on the development potential of the Tongue River for irrigation and power production. Construction began on the Tongue River Irrigation Project in 1907. Early

irrigation development on the Reservation consisted of the Birney Project, which planned for 6,000 to 7,000 acres of land to be irrigated by means of the Birney Canal. However, only 1,200 acres were potentially serviceable, due to difficult construction and inadequate water. Only about 6.8 miles of the original 25-mile canal were constructed and irrigating about 600 acres of land.

The project was later modified to serve 1,380 acres of land. Tongue River water was provided by 14 pumping units, which were developed to various levels of completion. (Allen, 1947; HKM, 1976) The 14 Indian irrigation units along the west side of the Tongue River were originally referred to as:

- Birney Diversion Unit
- Cook Creek Pump Unit
- MedicineTop Pump Unit
- Standing Elk Pump Unit
- Pawnee Pump Unit
- Teepee Pump Unit
- Bighead Pump Unit
- Twofeather Pump Unit
- Tooey Pump Unit
- Logging Creek Pump Unit
- Little Coyote Pump Unit
- Ashland Pump Unit
- Shoulderblade Pump Unit
- Reservation Creek Pump Unit

The economy of the region was primarily based on cattle production; therefore, the predominant agricultural crops included hay, such as grass and alfalfa hay, and alfalfa seed and corn for silage and grain. Among the hay producing areas, some lands were sub-irrigated by means of taking advantage of naturally wet areas, and areas or which became wet as a consequence of the irrigation of other lands. Other lands along the Rosebud and Tongue River drainages were irrigated by surface water runoff concentrations and were often referred to as sub-irrigated lands. Historically there were a number of small diversions along Rosebud Creek, such as the Government Ditch near Busby, which had the capacity of about 200 acres. (HKM, 1976).

*b. Present Irrigation*

Of the Reservation's 444,524 acres, 391,852 acres are considered rangeland, 11,799 are dryfarmed and 1,794 acres are irrigated. (Northern Cheyenne Tribe, 1989). Figure 6-3 shows locations of historical and presently existing irrigation systems. The soils of the Reservation were surveyed and mapped in 1975 as a conjunctive effort made by the Tribe, Bureau of Indian Affairs, the Rosebud and Bighorn County Conservation Districts and the Soil Conservation Service. This soil survey provides information regarding the types and locations of soils located on the Reservation. (Northern Cheyenne Tribe, 1976).

*c. Potential Irrigation*

Numerous studies have been conducted for purposes of defining irrigation potential of the Reservation. An economic study of irrigation potential on the Reservation provides estimated returns of irrigated and subirrigated agriculture for 4,770 and 3,110 acres of land located within the Tongue River and Rosebud Creek drainages respectively. This study was based on cultivation of alfalfa, alfalfa seed, malting barely, feed barley, spring wheat, and corn silage. The results of this study demonstrated economic feasibility. (Dornbusch, 1984).

In 1976, a land classification study was undertaken by HKM Associates for the purpose of determining the potential of Reservation lands suitable for irrigated agriculture. This semi-detailed classification identified about 62,000 acres of arable land within the Reservation, of which 21,160 acres were identified as irrigable by means of gravity or sprinkler systems. At that time, the study identified 1,240 acres of land as presently irrigated with the remaining 19,920 acres of land is comprised of 2,320 acres of Class 1 land, 5,820 acres of Class 2 land, 8,220 acres of Class 3 land, and 3,560 acres of Class 4 land.

Various estimates of crop water requirements were determined. One analysis, using the SCS Modified Blaney-Criddle method and the SCS effective rainfall method determined seasonal, net irrigation requirements for the Tongue River Drainage, to be 20.36, 11.94 and 14.74 inches of water seasonally, for alfalfa, small grain and corn respectively. Seasonal, net irrigation water requirements for the Rosebud drainage were 19.03 inches per acre for alfalfa and 10.73 inches per acre for small grain. The total project acreage and project water demand identified in this study were 10,710 acres and 24,975 acre-feet of water annually. (Stetson, 1983).

Subsequent to the common use of the SCS Modified Blaney-Criddle method, it has been shown that this method tends to underestimate evapotranspiration by about 10%, when compared to lysimeter measurements made at Kimberly, Idaho. (American Society of Civil Engineers, 1990). Therefore, evapotranspiration and the net irrigation requirement and project diversion requirements for the Reservation are likely higher, for the same cropping patterns.

A more recent irrigation development study was conducted by MSE-HKM Engineering (1995). This study looked at specific areas in the Rosebud Creek and Tongue River drainages in detail for purposes of exploring the expansion of existing farmed areas for the benefit of the Tribe. Preliminary designs and costs were generated for select irrigation units located at Busby, Muddy Creek, Lame Deer, and Teepee Farms. This study indicates that:

> A long range plan for the Northern Cheyenne Indian Reservation could incorporate an extensive irrigation system approaching 10,000 acres depending on available water supplies. However, project water demands were not specified.

Water from the Tongue River on the eastern side of the reservation could be used to supply a series of center pivots, big gun, and side roll systems. A series of wells along Rosebud Creek could serve various irrigation systems in those areas. Irrigation in the central portion of the reservation is also a possibility to be investigated. Mobile irrigation systems may be implemented where topography and field shape are appropriate as these systems are economical, efficient, and require less operation and maintenance than manually moved irrigation systems. (MSE-HKM, 1995)

#### 2. Non-Irrigation Agricultural Water Use.

Apart from irrigation, agricultural water uses are relatively modest. Stock water use is probably the most notable non-irrigation, agricultural demand. In the future, it is possible that similar water demands may arise for such purposes as aquaculture.

A summary of stock water use includes the water consumed by stock as well as losses associated with the process of stock watering. These are mostly evaporation and seepage from stock ponds. Dornbusch & Company performed a review of stock water use requirements for the Northern Cheyenne Reservation in 1984. The summary was based on an average annual Reservation rate of 9,678 animal units and 12 gallons per day per head. The report concluded that 130 acre-feet of water would be consumed, 359 acre-feet would evaporate and 497 acre-feet would be lost due to seepage from ponds. The total amount of water related to stock use was therefore 986 acre-feet per year. (Dornbusch, 1984).

### B. Non-Agricultural Water Use.

#### 1. Domestic Water.

Groundwater resources provide the majority of the domestic water supply for the Reservation. Most reservation residents rely on groundwater of poor quality and often-insufficient quantity for their needs.

*a. Community Water Systems*

Each of the five Reservation communities is served by community wells and water storage systems. The water is pumped into storage tanks and gravity-fed to residents connected to the system's water lines. (Little Coyote, 2001). Information regarding the five community water systems was obtained from the Northern Cheyenne Utilities Manager. (Scalpcane, 2002). Further information about community water systems is contained in Chapter 5, Part II.A. The Tribe is currently searching for information about which aquifers the community wells are completed in.

1. Lame Deer Community Water System

Five wells serve those connected to the Lame Deer Community Water System. The average well depth is 88 feet below ground surface (b.S.). Wells #1 and #2 are located in Pumphouse A and yield 190 gallons per minute (gpm). Well #3 is located in Pumphouse B and yields 95 gpm. Pumphouse C contains well #4 which yields 95 gpm and Pumphouse D contains well #5. Well #5 yields 230 gpm and is treated with chlorine. Water is pumped continuously and stored in two 200,000 gallon elevated storage tanks and one 326,000 gallon underground storage tank and distributed to approximately 770 service connections (1995). There are 280 fire hydrants connected to the Lame Deer System. Often times the water pressure is not adequate in the summer months to provide fire protection.

2. Busby Community Water System

Five wells have been drilled to serve the Busby community; however, three of these wells are not in use due to elevated TDS concentrations. The two wells in operation are 260 and 280 feet deep and yield 50 gpm each. Water is contained in five 20,000-gallon underground storage tanks and serves 116 connections (1998). The water in Busby is treated with a water softener and a venturi fluoridation unit.

3. Ashland Community Water System

The Ashland Community Water System is served by one well, which is 110 feet deep and yields 51 gpm. Water is stored in a 15,000-gallon and a 35,000-gallon storage tank and distributed to approximately 38 service connections (1998). The Ashland Community Water System contains a Reverse Osmosis Treatment Plant to remove sulfate, iron and manganese from the water.

4. Birney Community Water System

Three wells have been drilled to serve the Birney community; however, only one of these wells is in use. The well in use is approximately 80 feet deep and yields 32 gpm. Water is stored in two 20,000-gallon underground storage tanks. The water use has been estimated to be about 60 gallons per day and there are 25 connections to the system (1998). A Reverse Osmosis Treatment Plant is used to treat the water.

5. Muddy Cluster Community Water System

Four wells have been drilled; however only one well is in use. Three of the four wells are not used due to high unspecified secondary contaminant levels. Water is contained in one 48,000-gallon storage tank and two 30,000 underground storage tanks. A Reverse Osmosis Water Treatment Plant is used to remove sulfate, iron and manganese from the water.

*b. Individual Water Supply*

Those residential homes not connected to a one of the district water systems contain an individual domestic supply well. The IHS provides well drilling and septic tank installation free for Native Americans on the Reservation. (BLM, 1989). Non-Native Americans on the Reservation fall under the jurisdiction of the county health departments. (BLM, 1989). Eighty percent of the wells for homes off Highway 212 produce water which does not meet Federal Secondary Drinking Water Standards. (BOR, 1995).

*c. Domestic Water Use*

Combined residential water use is estimated to be 130 gallons per capita per day (gpcpd). (BOR, 1995). With an on-Reservation population of approximately 4,470 people (2000 Census), the average day domestic water use is 0.581 million gallons per day. (MGD).

**2. Commercial.**

The town center of Lame Deer contains a majority of the commercial development on the Reservation. The central district is composed of the Tribal headquarters, supermarket, convenience store and gas station, car care service, café, church, telephone exchange, bank, and several small businesses. (Little Coyote, 2001). Nearby are Dull Knife Memorial College, the elementary school, Tribal Health Service, Indian Health Service, Bureau of Indian Affairs, the Charging Horse Casino and various Tribal facilities. It is a concern that existing water and sewer services prevent further commercial development in the future.

Commercial water use is estimated to be 35 gpcpd. (BOR, 1995). Assuming that the commercial development on the Reservation has not changed dramatically since 1994, the average day water use is estimated to be 0.1565 MGD.

**3. Municipal**

Municipal water use describes water use in public areas, community areas and government buildings. Municipal water use is estimated to be 9 gpcpd. (BOR, 1995). Using this figure, the average day water use is calculated to be 0.0402 MGD.

**4. Industrial**

Currently, no industrial development is occurring on the Reservation. Potential industrial operations include the saw mill and development of coal related resources. These potential uses are not accounted for in the current water use.

*a. Saw Mill*

The Tribe's Tongue River Lumber Company (TRLC) saw mill is temporarily shut down as of March 2001 for financial reasons. (Little Coyote, 2001). The average water use during operation is not known.

*b. Development of Coal and Other Energy Resources*

The Reservation possesses substantial coal resources and potentially significant amounts of oil and gas resources. Studies pertaining to the development potential of these resources on the Reservation have been done. Table 6-20 describes industrial water use associated with resource development if it should ever occur on the Northern Cheyenne Indian Reservation.

### 5. Non-Agricultural Water Use Summary.

The daily per capita water use on the Reservation was estimated by the BOR for 1994 to be 189 gpcpd. This is distributed between residential water use, commercial water use, municipal water use and unaccounted-for losses. (BOR, 1995). The combined average non-agricultural water use is estimated to be 0.8449 MGD (954 acre-feet/yr) on the Reservation. This accounts for losses in the system due to line leakage and meter slippage (0.0671 MGD).

Average use does not account for daily fluctuations in water use. Peaking factors are used to compute the maximum ~~pay~~day and the maximum momentary water use rates, based on average day use. A peaking factor of 2.75 was used (BOR, 1995) to yield a peak day water use of approximately 2.323 MGD (2,580 acre-feet/yr).

## C. Water Marketing.

Water marketing does not mean the permanent sale of water, but rather it represents the contracting of water for fixed periods of time without the relinquishing of any water right held by the offeror. Water marketing of Reservation water by the Tribe is a source of great potential benefit. The Tribe has large water resources at its disposal by virtue of its early priority and federally reserved water right. Specific quantities of water associated with the Tribe's right are designated for any beneficial use, water that can very well be used for purposes off the Reservation.

### 1. Sources of Water

Possible sources of water that the Tribe may elect to market are:

- The diversion of 30,000 acre-feet per year from the Bighorn Lake at Yellowtail Dam for any beneficial use.

- The diversion of 32,500 acre-feet from the Tongue River for any beneficial use.

- An additional 19,530 acre-feet from Rosebud Creek, for any beneficial use subject to the constraint that diversion and use do not adversely affect other water right holders of priority June 30, 1973 and earlier.

### 2. Markets and Demand.

Water marketing generally follows from a business arrangement between the party seeking to sell water to others who agree on the amount of water, type of use, time of use, duration of contract and other considerations. Some of these considerations included the environmental conditions and issues regarding navigation, flood control and channel capacity. This varies depending on many factors related to the potential market area boundary, which is a function of source location, point(s) of diversion, method and path of conveyance and location and type of use. Definitions of beneficial use also vary and may affect the development of a particular water market.

Possible markets for Northern Cheyenne water include power production, mining and energy related consumption. The market boundary for such uses could vary from local to regional extent because of the existence of coal throughout the Powder River basins. Other future potential markets could include municipal, irrigation and other industrial uses. A summary of anticipated industrial water use is shown in Table 6-13, which is adapted from a table appearing in a draft report entitled Northern Cheyenne, Feasibility of Developing Coal Resources. (Dornbusch, 1984).

**Table 6-13 – Anticipated Industrial Water Use**

| Type of Development | Unit Size | Consumption (acre-feet/yr) |
|---|---|---|
| Coal Mine | 10 million tons/year | 640-1,050 |
| Coal Fired Power Plant | 500 Mega Watt | 8,300 |
| Coal Liquefaction | 50,000 barrels per day | 14,500 |
| Coal Gasification | 250 mmscft | 9,100 |
| Coal Slurry Pipeline | 10 million tons/year | 6,000 |

Dornbusch, 1984

## IV. Air Resources.

### A. History

In the 1970's, two 750 MW coal-fired power plants were being planned in Colstrip, Montana, about 13 miles from the northern boundary of the Reservation. The Tribe, concerned about the resulting air pollution, took action that changed the legal standard. On August 5, 1977, the Northern Cheyenne Tribe became the first government in the Nation – federal, state, local or tribal - to voluntarily raise the air quality standard to the most pristine standard under law, Class I. This classification resulted in the installation of the most stringent air pollution control technology available in the Colstrip power plants.

The rest of the Tongue River Basin is classified as Class II under the federal Prevention of Significant Deterioration (PSD) regulations, allowing for moderate air quality deterioration. The Class I designation on the Northern Cheyenne Reservation restricts increases in ambient air pollutant levels to a much smaller increment than the Class II designation. (Table 6-14).

**Table 6-14 – Federal Prevention of Significant Deterioration Allowable Increments**

| Standards | ($ug/m^3$) | National Ambient | Class I | Class II |
|---|---|---|---|---|
| Particulates | Annual Arith. Mean | 50 | 4 | 17 |
| | 24-hr Average | 150 | 8 | 30 |
| Sulfur Dioxide | Annual Arith. Mean | 80 (0.03 ppm) | 2 | 20 |
| | 24-hr Average | 365 (0.14 ppm) | 5 | 91 |
| | 3-hr Average | 1300 (0.50 ppm) | 25 | 512 |
| Nitrogen Dioxide | Annual Arith. Mean | 100 (0.053 ppm) | 2.5 | 25 |

Data from EPA website, www.epa.gov and BLM, 2002

## B. Air Quality Monitoring and Enforcement.

An agreement between the Tribe and Montana Power Company, now Pennsylvania Power and Light (PP&L) consists of monitoring stations at the northern boundary of the Northern Cheyenne Reservation. The monitoring stations are called PSD (Prevention of Significant Deterioration) sites. All monitoring and equipment is paid for by PP&L and has been running from March 1981 through the present. There are three monitoring stations that measure $SO_2$, $NO_2$, wind speed and direction, precipitation, barometric pressure, solar radiation, temperature, and dew point. One of the sites contains a nephelometer to monitor visibility. Also, a digital camera takes two pictures per day of the Colstrip power plants, one at 9:00 am and one at 3:00 pm. Since 1996, the Tribe has been responsible under contract for the maintenance, calibration and reporting of these three stations. Reports go to the Montana Department of Environmental Quality (MDEQ), the EPA, and PP&L. (Littlewolf, 2002).

$SO_2$ and $NO_2$ data from January 1999 through June 2000 are available from the Garfield PSD and the Badger PSD and represent baseline air quality characteristics on the northern boundary of the Reservation. Graphical representation of the data are presented in Appendix E. The data indicate that $SO_2$ during this time ranged from zero to 0.021 ppm based on hourly data; however, the annual average averages remain close to zero. (Littlewolf, 4/12/02). $NO_2$ values ranged from zero to 0.034 ppm. The annual average for $NO_2$ is usually very close to zero.

According to Jay Littlewolf (2002), other monitoring occurs in Lame Deer through various EPA grants. PM-10 monitoring was initiated in Lame Deer in 1988. Approximately 5 years ago, through an EPA Clean Air Act Section 105 Grant, a Continuous Real Time Monitoring System (TEOM) was installed. Monitoring occurs on a daily basis from midnight to midnight for PM-10, wind speed and direction, temperature, barometric pressure, and precipitation. At the same site in Lame Deer, through an EPA 103 Grant, PM-2.5 monitoring occurs. This involves taking a sample once every three days for analysis at an

outside laboratory. Also approved on an EPA Section 103 Grant, but not yet implemented, is a visibility monitoring system called IMPROVE (Interagency Monitoring of Protected Visual Environments).

A summary of PM-10 data obtained from 1999-2000 quarterly reports are presented in Appendix E, Tables 1-2. Table 1 represents quarterly arithmetic mean concentrations of 24-hour average readings taken every six days in the quarter. The range of readings throughout the quarter is also presented. The mean values fluctuate between 10 and 22.9 ug/$m^3$ in 1999-2000. The PM-10 24-hour average "not to exceed" value is 150 ug/$m^3$. In the past, this standard has been exceeded, but not in 1999-2000. Table 2 represents quarterly mean concentrations of daily PM-10 data in ug/$m^3$. Daily values in 1999 and 2000 ranged from 1.6 to 131.3 ug/$m^3$.

If air quality parameters are exceeded, the EPA is responsible for the enforcement of the standards. The Tribe is working towards developing a mechanism for enforcing Tribal air quality standards through the development of a TIP (Tribal Implementation Plan), which has to be approved by the EPA. (Littlewolf, 2002).

### C. Lame Deer PM-10 Non-Attainment.

On August 7, 1987, Lame Deer was designated as an area having the potential to exceed the National Ambient Air Quality Standard (NAAQS) for PM-10, a measure of 10-micron or smaller suspended particulates (Appendix E; Tables 1-2). Studies indicate that airborne road dust is the cause of the noncompliance. (MDNRC, 1996). According to the Tribe, magnesium chloride is being used on some road sections of the Reservation and may reduce the sanding material applied to roads. Other existing sources of air pollution on and surrounding the Reservation include coal-fired power plants, coal strip mines, agricultural operations, wood waste burning and home heating, vehicle traffic on unpaved roads and wind erosion from exposed areas.

## V. Mineral Resources.

Mineral resources on the Northern Cheyenne Indian Reservation consist primarily of coal and its derivatives. There are no known occurrences of metallic minerals. Non-metallic minerals include building stone, sand and gravel, bentonite, claystone, and clinker deposits. (Mapel, 1975).

### A. Coal.

Coal is one of the most abundant and valuable mineral resources on the Northern Cheyenne Reservation. The Tribe controls an estimated 450,000 acres of coal rights lying in Bighorn and Rosebud Counties, MT. (Stagg, 1994). The coal resources on the Reservation, contained within the Fort Union Formation, are classified as subbituminous in rank, with a relatively high moisture content, a low ash and sulfur content, and a relatively high heat content. (Stagg, 1994; Mapel, 1975).

Several estimates of the coal reserves on the Northern Cheyenne Reservation have been made. The US Geological Survey and the US Bureau of Mines estimated the total coal reserves on the Reservation to be 23 billion tons, of which 5-6 billion tons may be mined by surface methods. (Mapel, 1975). A more specific study was conducted in the vicinity of Rosebud Creek which estimated that there are 4.8 billion tons of coal in that region, of which 1.8 billion tons is strippable. (Heffern, 1979). A study by Stagg Engineering on the Knobloch Coals on the Reservation near the Tongue River estimated coal resources to exceed 56 billion tons of coal, of which 3.3 billion tons would be strippable. (Stagg, 1994). In all cases, it has been estimated that the Northern Cheyenne Tribe owns at least 5 billion tons of minable coal on the Reservation.

### B. Conventional Oil and Gas.

Underground accumulations of oil and gas can occur where structural traps such as domes or anticlines or stratigraphic traps locally impede migration. The Northern Cheyenne Reservation has been prospected for oil and gas intermittently since 1952, but none has been found. (Mapel, 1975). Geologic relations and trends indicate that oil and gas accumulations could be present on the Reservation and increased attention is given to the Greybull Sandstone. (Lopez, 2000). Potential reserves for this lead are estimated at 6.4 million barrels of oil. (Lopez, 2000). Confirmed oil and gas resources on the Northern Cheyenne Reservation cannot be quantified at this time.

### C. Coalbed Methane.

Initial estimates of methane gas on the Reservation were approximately three billion cubic feet. (Little Coyote, 2001). Five wells were drilled on the Reservation and minimum amounts of gas were found. The highest gas content measured was 65 $ft^3$/ton. At that time, the range of profitable yield was 55 to 164 $ft^3$/t, and the conclusion of the study was that methane gas development would be uneconomical. (Little Coyote, 2001; Herco/Hampton, 1989).

In 1991, the Tribe received funding from the BIA to evaluate the Reservation's coal beds for the presence of methane gas. Two wells were drilled and a variety of tests were performed both on the well and on the core and cuttings. It was determined during this project that the outcrop pattern of the coal beds along the topographic divide suggests that most of the coal beds between the Tongue River and Rosebud Creek will have a low hydrostatic head and minimal amounts of methane. This does not detract from the high potential for methane retained in a coal seam totally disconnected to outcrop. (Northern Cheyenne Tribe, 1991).

## D. Non-Metallic Minerals

### 1. Bentonite.

Bentonite is a type of clay consisting essentially of the mineral montmorillonite. It is used in drilling mud, foundry sand, animal feed, and for waterproofing and sealing, pond lining, and many other industrial applications. The bentonite exposed on the Northern Cheyenne Reservation is not of sufficient quality or quantity to be of significant potential economic importance; however, the reserves are adequate for the local needs of the Northern Cheyenne Tribe in the foreseeable future. (Mapel, 1975).

### 2. Building and Ornamental Stone.

The Tribe has locally mined sandstone for construction purposes for many years. Sandstone outcrops on the Reservation are extensive; however, most of it is too massive or not sufficiently indurated to be suitable for mining. (Mapel, 1975). Clinker deposits are used to a limited extent as a building and ornamental stone. These resources will continue to be used locally and represent a valuable resource to the Tribe although little economic value can be assigned.

### 3. Claystone and Shale.

The Tongue River Member of the Fort Union Formation contains claystone and shale that is suitable for making brick, and could also be used as a lightweight aggregate for concrete. (Mapel, 1975). Test results just south of the Reservation performed by the Montana Bureau of Mines and Geology suggest that the Reservation contains substantial and wide spread clay resources suitable for brick and aggregate uses. (Berg and others, 1973).

### 4. Clinker.

Clinker is a term used to describe the partly melted and vitrified rock that are produced from the fusing and melting of an overlying formation by the intense heat that rises from an underlying burning coal bed. (Mapel, 1975). Coal beds in the Tongue River Member of the Fort Union Formation more than about 5 feet thick commonly have burned along their outcrops, leaving conspicuous shades of red, erosion-resistant rock on the Reservation. Clinker deposits are abundant on the Reservation. The greatest potential use for clinkers on the Northern Cheyenne Reservation is for road material. Clinker is also crushed and used for roofing granules and walkways, etc.

### 5. Sand and Gravel.

Productive deposits of sand and gravel occur along the Tongue River and Rosebud Creek. The deposits are used locally for road construction and maintenance; however, these deposits are neither plentiful nor of particularly good quality to be used as an economic resource. (Mapel, 1975).

## VI. Fish and Wildlife.

### A. Wildlife.

Wildlife inhabits all parts of the Reservation and has much cultural and economic importance to the Tribe. The Reservation environment supports a variety of wildlife including big game animals, small mammals, migratory birds, raptors, waterfowl, amphibians, and reptiles. The aquatic resources are just as diverse including some 32 different fish species. Population levels are impossible to estimate because essential population data has not been collected and unregulated hunting has made most species very wary and difficult to monitor. However, indications from the limited data collected are that big game populations are far below what the habitat can support. Table 6-24 summarizes estimated population of different wildlife species on the Reservation in 1972.

Wildlife inventories, wooded riparian corridor types, and critical wildlife areas were documented as part of the Northern Cheyenne Tongue River Watershed Conservation Plan in 1994. During a two-week inventory completed in late July and early August, 49 wildlife observations were made. There were approximately 234 miles of wooded riparian corridors identified. A variety of wildlife species were observed while conducting the range and grazeable woodland inventory. The mule deer was the only game animal observed. Game birds included sharp-tailed grouse, sage grouse, turkey and mourning doves. Raptors included the golden eagles, prairie falcons, American kestrel, red-tailed hawk, northern goshawk and turkey vulture. Non-game observations included prairie dogs, rattlesnakes, white-tailed jackrabbits, cottontails and pine squirrels. Observations of predators were limited to the coyote.

#### 1. Mammals.

The variable topography and cover types on the Reservation support several mammal species. Big game species on the Reservation are white-tailed deer, mule deer, pronghorn antelope, elk, buffalo, black bear and mountain lion. Upland game birds, wild turkeys, hawks, eagles, mule and white-tailed deer, pronghorn antelope, and elk are all of particular importance to the Tribe. The deer population has decreased recently as the result of year around hunting; elk migrate through the Reservation, but do not remain. (Northern Cheyenne Tribe, 1999).

Non-game species include white-tailed jackrabbits, prairie dogs, cottontails, beavers, muskrat, mink and pine squirrels. Prairie dog towns provide habitat for many vertebrate species, including several rare or endangered species such as the burrowing owl, mountain plover, and black-footed ferret. Predators include coyote, black bear and mountain lion.

The reach of the Tongue River bordered by the Northern Cheyenne Reservation includes about 2,584 acres of riparian hardwood forest and 2,159 acres of riparian grasslands. (Northern Cheyenne Tribe, 1996). Historically the Tongue River breaks provided excellent habitat for elk, deer, and pronghorn. Mule deer especially thrived in the open, broken topography of the breaks. Upper Logging, Kelty, and Tie Creeks offer prime habitat; including meadows, ravines, steep dry slopes, brushy draws, along with patches of dense timber. The potential for 10 mule deer and 3 to 5 elk per square mile exists.

Tribal members have always valued the forest for hunting. Currently, deer levels are extremely depressed due to year-around hunting. Occasionally elk move onto the Reservation from surrounding areas, but they rarely stay around long. Nonetheless, the mix of forest cover, riparian habitat, and rolling grassland qualifies as prime mule deer and elk habitat. In particular, the rough, rocky terrain of the Tongue River breaks is ideal for both forage and security.

### 2. Birds.

As noted for mammals, the variable topography and cover types on the Reservation support several bird species. A bird inventory was conducted from 1998-2001 on the Northern Cheyenne Reservation. (Northern Cheyenne Tribe, 2001e). In addition to waterfowl, raptors and upland game birds, many passerine birds were observed on the Reservation. These include mountain bluebird, red breasted nuthatch, house wren, eastern and western kingbird, brown headed cowbird, robin, brown thrasher, red-winged blackbird, common grackle, common nighthawk, and northern flicker. (Northern Cheyenne Tribe, 1996). A total of 114 bird species were identified in the inventory. (Table 6-15).

#### *a. Waterfowl*

The Northern Cheyenne Indian Reservation is located within the Central Flyway, which contains important migration corridors. Bighorn, Rosebud, Treasure, and Yellowstone counties are a major habitat for nesting, migrating and wintering waterfowl. Rivers and stockponds in the region provide important habitat for resident ducks and nesting areas for migrants. A large variety of ducks, geese, and shorebirds use riparian-wetland habitats within the region for nesting and migration stopovers. Common species observed downstream of the Tongue River Reservoir include Canadian geese, common mergansers, mallards, shovelers, and blue-winged and green-winged teal, pintail, and gadwall. (Northern Cheyenne Tribe, 1996).

*b. Raptors*

Raptors on the Reservation include bald and golden eagles, peregrine falcons, harriers, American kestrels, red-tailed hawks, sharp skinned hawks, northern goshawks and turkey vultures. Reservation owl species include the snowy owl, burrowing owl, screech owl, short-eared owl, and great horned owl. (Northern Cheyenne Tribe, 1989).

Some of these raptors have been identified by the State of Montana, the USFS, or the BLM as sensitive species or species of concern. Those listed by the State include northern goshawk, golden eagle, peregrine falcon, and the burrowing owl.

*c. Upland Game Birds*

These include the sharp-tailed grouse, sage grouse, Hungarian partridge, ringneck pheasant, turkey and mourning doves. (Northern Cheyenne Tribe, 1989). Sharp-tailed grouse are generally found in the grassland, shrub-grassland, and woodland vegetation areas. Their habitat includes hills, benches, and rolling topography that have good stands of residual cover composed chiefly of grasses for roosting, feeding and nesting.

Sage grouse are widely distributed in suitable habitat, but because numbers have declined significantly over the last 20 years they are a possible candidate for listing under the Endangered Species Act (ESA). Sage grouse are primarily associated with big and silver sagebrush communities in grassland-shrub and shrub vegetation types. The importance of mature sagebrush with a good under story of grasses and forbs to sage grouse is well documented.

**Table 6-15** - Bird Species Identified on the Northern Cheyenne Indian Reservation, 1998-2001

| **Common Name** | **Scientific Name** | **Common Name** | **Scientific Name** | **Common Name** | **Scientific Name** |
|---|---|---|---|---|---|
| American Avocet | Recurvirostra americana | Dark-eyed Junco | Junco hyemalis | Red Crossbill | Loxia curvirostra |
| American Coot | Fulica americana | Downey Woodpecker | Picoides pubescens | Red-breasted Nuthatch | Sitta canadensis |
| American Crow | Corvus brachyrhynchos | Eastern Kingbird | Tyrannus tyrannus | Redhead | Aythya americana |
| American Goldfinch | Carduelis tristis | European Starling | Sturnus vulgaris | **Red-headed Woodpecker** | **Melanerpes erythrocephalus** |
| American Kestrel | Falco sparverius | **Ferruginous Hawk** | **Buteo regalis** | Red-shafted Flicker | Colaptes auratus cafer |
| American Redstart | Setophaga ruticilla | Gadwall | Anas strepera | Red-tailed Hawk | Buteo jamaicensis |
| American Robin | Turdus migratorius | Golden Eagle | Aquila chrysaetos | Red-winged Blackbird | Agelaius phoeniceus |
| American Wigeon | Anas americana | Gray Catbird | Dumetella carolinensis | Ring-necked Pheasant | Phasianus colchicus |
| **Bald Eagle** | **Haliaeetus leucocephalus** | Great Blue Heron | Ardea herodias | Rock Dove | Columba livia |
| Bank Swallow | Riparia riparia | Great Horned Owl | Bubo virginianus | Rock Wren | Salpinctes obsoletus |
| Barn Swallow | Hirundo rustica | Green-winged Teal | Anas crecca | Sandhill Crane | Grus canadensis |
| Belted Kingfisher | Ceryle alcyon | Hairy Woodpecker | Picoides villosus | Say's Phoebe | Sayornis saya |
| **Black-and-white Warbler** | **Mniotilta varia** | Horned Grebe | Podicepts auritus | Sharp-tailed Grouse | Tympanuchus phasianellus |
| **Black-backed Woodpecker** | **Picoides arcticus** | Horned Lark | Eremophila alpestris | Song Sparrow | Melospiza melodia |
| Black-billed Magpie | Pica pica | House Sparrow | Passer domesticus | Spotted Sandpiper | Actitis macularia |
| Black-capped Chickadee | Parus atrucapillus | House Wren | Troglodytes aedon | Spotted Towhee | Pipilo maculatus |
| Black-headed Grosbeak | Pheucticus melanocephalus | Killdeer | Charadrius vociferus | Swainson's Hawk | Buteo swainsoni |
| Blue-winged Teal | Anas discors | Lark Bunting | Calamospiza melanocorys | Townsend's Solitaire | Myadestes townsendi |
| Bohemian Waxwing | Bombycilla garrulus | Lark Sparrow | Chondestes grammacus | Tree Swallow | Tachycineta bicolor |
| Brewer's Blackbird | Euphagus cyanocephalus | Lazuli Bunting | Passerina amoena | Turkey Vulture | Cathartes aura |
| Brewer's Sparrow | Spizella breweri | Lesser Scaup | Aythya affinis | Upland Sandpiper | Bartramia longicauda |
| Brown Thrasher | Toxostoma rufum | **Lewis' Woodpecker** | **Melanerpes lewis** | Veery | Catharus fuscescens |

| **Common Name** | **Scientific Name** | **Common Name** | **Scientific Name** | **Common Name** | **Scientific Name** |
|---|---|---|---|---|---|
| Brown-headed Cowbird | Molothrus ater | Long-billed Curlew | Numenius americanus | Vesper Sparrow | Pooecetes gramineus |
| **Burrowing Owl** | **Speotyto cunicularia** | Mallard | Anas platyrhynchos | Violet-green Swallow | Tachycineta thalassina |
| Canada Goose | Branta canadensis | Marbled Godwit | Limosa fedoa | Western Kingbird | Tyrannus verticalis |
| Cassin's Finch | Carpodacus cassinii | Marsh Wren | Cistothorus palustris | Western Meadowlark | Sturnella neglecta |
| **Cassin's Kingbird** | **Tyrannus vociferans** | Merlin | Falco columbarius | Western Tanager | Piranga ludoviciana |
| Cedar Waxwing | Bombycilla cedrorum | Mountain Bluebird | Sialia currucoides | Western Wood-Pewee | Contopus sordidulus |
| Chimney Swift | Chaetura pelagica | Mourning Dove | Zenaida macroura | White-crowned Sparrow | Zonotrichia leucophrys |
| Chipping Sparrow | Spizella passerina | Northern Flicker | Colaptes auratus | White-throated Swift | Aeronautes saxatalis |
| Clark's Nutcracker | Nucifraga columbiana | **Northern Goshawk** | **Accipiter gentilis** | Wild Turkey | Meleagris gallopavo |
| Clay-colored Sparrow | Spizella pallida | Northern Harrier | Circus cyaneus | Wilson's Phalarope | Phalaropus tricolor |
| Cliff Swallow | Hirundo pyrrhonota | Northern Oriole | Icterus spp. | White-breasted Nuthatch | Sitta carolinensis |
| Common Goldeneye | Bucephala clangula | Northern Pintail | Anas acuta | Wood Duck | Aix sponsa |
| Common Grackle | Quiscalus quiscula | Northern Rough-winged Swallow | Stelgidopteryx serripennis | Yellow Warbler | Dendroica petechia |
| Common Nighthawk | Chordeiles minor | Northern Shoveler | Anas clypeata | Yellow-breasted Chat | Icteria virens |
| Common Yellowthroat | Geothlypis trichas | Pine Siskin | Carduelis pinus | Yellow-headed Blackbird | Xanthocephalus xanthoceph |
| Cooper's Hawk | Accipiter cooperii | Prairie Falcon | Falco mexicanus | Yellow-rumped Warbler | Dendroica coronata |

**Bold** indicates Species of Concern; underlined indicates Species on Review (MT Natural Heritage Program, 2001)

### 3. Reptiles and Amphibians.

Specific data on reptiles and amphibians on the Reservation is lacking, however, rattlesnakes were observed. The 1998 Montana Gap Analysis Project (MT-GAP) indicates that Rosebud and Bighorn Counties among several others in southeastern Montana support 9 species of amphibians and 14 species of reptiles. These include one species of salamander, four species of frogs, four species of toads, three species of turtles, two species of lizards, and nine species of snakes. The Montana Fish, Wildlife, and Parks has expressed particular concern about five of these species including the northern leopard frog, tiger salamander, hognose snake, milk snake, and the spiny softshell.

Leopard frogs and the northern chorus frog were observed in the Tongue River Reservoir area. The snapping turtle also has been seen. Other common species associated with aquatic habitats for some part of their life cycle are likely to include: the tiger salamander, plains spadefoot toad, painted turtle, and spiny-softshell turtle.

Leopard frogs are locally abundant in southeastern Montana. They are associated with permanent slow moving water bodies with considerable vegetation, but may also range into moist meadows and grassy woodlands and occasionally agricultural areas. They are most often associated with riparian habitats and on prairies near permanent water. Tiger salamanders occur throughout the planning area wherever there is terrestrial substrate suitable for burrowing and a nearby body of water for breeding. (MT-GAP, 1998).

### 4. Species of Concern.

Species currently listed as threatened, endangered or candidate species under the Endangered Species Act (ESA) that occur or may be present on the Northern Cheyenne Reservation include the bald eagle, peregrine falcon, swift fox, and mountain plover. Prairie dog colonies also provide potential habitat for black-footed ferrets. (Northern Cheyenne Tribe and BIA, 1999). In addition to species that are federally protected under the Endangered Species Act, the State of Montana has designated additional species of concern within its jurisdictional boundaries. There are five rankings for State Species of Special Concern; the highest ranking is classified (S1). State Species of Special Concern that occur or may be present on the Reservation include the swift fox, northern goshawk, burrowing owl, and the black-tailed prairie dog. Table 6-16, includes species listed or proposed for protection under the Endangered Species Act and mentioned in the DEIS and, species classified as sensitive by the BLM and US Forest Service, and species considered to be critically imperiled in the State of Montana that may occur on the Northern Cheyenne Reservation.

Section 7(c) of the ESA requires that federal agencies proposing actions complete a biological assessment to determine the effects of the proposed actions on listed and proposed species. Additionally, birds, raptors, and eagles are protected under the Migratory Bird Treaty Act and Bald Eagle Protection Act. The Migratory Bird Treaty Act, 16 U.S.C. 703, enacted in 1918 does not require intent to be proven and prohibits the taking of any migratory birds, their parts, nests, or eggs except as permitted by regulations. Section 703 of the Act states, "Unless and except as permitted by regulations... it shall be unlawful at any time, by any means or in any manner, to take, capture, kill, attempt to take, capture, or kill, or possess ... any migratory bird, any part, nest, or eggs of any such bird...". The Bald Eagle Protection Act, 16 U.S.C. 668, prohibits knowingly taking, or taking with wanton disregard for the consequences of an activity, any bald or golden eagles or their body parts, nests, or eggs, which includes collection, molestation, disturbance, or killing activities. Permits for Native American ceremonial use of eagle parts are available. Violation of these prohibitions is a criminal violation regardless of where the activity occurs, whether it is on public or private lands.

**Table 6-16 -** Species of Concern found on or adjacent to the Northern Cheyenne Reservation (NCT, 2001e) and Federally Listed Endangered, Threatened, and Proposed Animal Species Present in Southeast, South Central, and North Central Montana. (as listed in BLM, 2002).

| Common Name | Scientific Name | State of Montana Rank (1) | US Fish and Wildlife Service Federal Status (2) | US Forest Service (3) | BLM (4) |
|---|---|---|---|---|---|
| Bald Eagle | Haliaaeetus leucocephalus | S3 | T | | |
| Black-and-white Warbler | Mniotilta varia | S2/S3 | | | |
| Black-backed Woodpecker | Picoides arcticus | S3 | | S | SS |
| Black-footed Ferret | Mustela nigripes | S1 | E | | |
| Black-tailed Prairie Dog | Cynomys ludovicianus | S3/S4 | C | S | SS |
| Burrowing Owl | Athene cunicularia | S3 | | S | SS |
| Cassin's Kingbird | Tyrannus vociferans | S2 | | | |
| Ferruginous Hawk | Buteo regalis | S3 | | | SS |
| Gray Wolf | Canis lupus | S2/S3 | E | | |
| Grizzly Bear | Ursus arctos horriblis | S2/S3 | T | | |
| Interior Least Tern | Sterna antillarum athalassos | S1 | E | | |
| Lewis' Woodpecker | Melanerpes lewis | S3/S4 | | | |
| Lynx | Lynx Canadensis | S3 | T | | |
| Milk Snake | Lampropeltus triangulum | S3 | | | |
| Mountain Plover | Charadrius montanus | S2 | PT | | |
| Northern Goshawk | Accipiter gentiles | S3/S4 | | S | SS |
| Northern Leopard Frog | Rana pipiens | S3 | | S | SS |
| Peregrine Falcon | Falco peregrinus | S2 | | S | SS |
| Red-headed Woodpecker | Melanerpes erythrocephalus | S3/S4 | | | |
| Snapping Turtle | Chelydra serpentine | S3 | | | SS |
| Spiney Softshell | Apalone spinifera | S3 | | | SS |
| Swift Fox | Vulpes velox | S3 | | S | SS |
| Western Hognose Snake | Heterodon nasicus | S3 | | | |

Rank and listing obtained from Montana Natural Heritage Program, 2001.

(1) S1 is critically imperiled because of extreme rarity or because of some factor making especially vulnerable to extinction; S2 is imperiled because of rarity or because of other factors demonstrably making it very vulnerable to extinction throughout its range; S3 is either very rare and local throughout its range, or found locally in a restricted range, or vulnerable to extinction throughout its range because of other factors.

(2) E is listed endangered; T is listed threatened; PE is proposed endangered; PT is proposed threatened; C is candidate.

(3) S is sensitive meaning that animal species identified by the Regional Forester for which population viability is a concern as evidenced by significant downward trend in population or a significant downward trend in habitat capacity.

(4) SS is special status meaning that federally-listed species or other rare or endemic species that occur on BLM lands.

*b. Threatened and Endangered Species Found on the Reservation*

*i. Mammals*

Black-tailed Prairie Dog. The black-tailed prairie dog warrants listing by the Fish and Wildlife Service under the Endangered Species Act; however, at this time it remains only a candidate for listing. This species is capable of colonizing a variety of shrub-grassland and grassland habitats. Generally, the most frequently used habitats in Montana are dominated by western wheatgrass, blue grama, and big sagebrush and located in relatively level areas in wide valley bottoms, rolling prairies, and the tops of broad ridges. The black-footed ferret is an obligate predator of prairie dogs. Other species with close associations to prairie dogs are burrowing owls, mountain plovers, and ferruginous hawks. These are all species of concern.

Black-footed Ferret. This species was listed as endangered on March 11, 1967. Black-footed ferrets depend almost exclusively on prairie dogs for food and shelter. Black-tailed prairie dogs and their burrows are fairly abundant in areas that have not been affected by the sylvatic plague. In 1994, approximately 75% of the land previously inhabited by prairie dogs on the Reservation were inactive due to an outbreak of the sylvatic plague. Since then some of the land has recovered and is being revegetated with native grass and forbs. (Northern Cheyenne Tribe, 1996).

Swift Fox. The swift fox is believed to originally have been abundant throughout its range on the Great Plains, including Montana east of the continental divide. It was extirpated early in this century from the northern portion of its range while remnant populations in the southern portion survived human settlement of the prairies. Although no quantitative analysis of swift fox habitat selection has been undertaken, numerous studies indicate that swift foxes use, and prefer, short to midgrass prairies. The swift fox is known to inhabit areas of mixed agricultural use, but in lower densities. (MDNRC, 1996).

*ii. Birds*

Mountain Plover. This species was proposed for listing as threatened on February 16, 1999. The mountain plover is known to breed in short-grass prairie and shrub-steppe landscapes, in dryland and cultivated farms, and in prairie dog towns. The mountain plover tends to nest in flat, disturbed areas with short vegetation, such as moderately grazed land and oil drill pads. They are rarely found near water. (USFWS, 1999).

Bald Eagle. This species was reclassified from endangered to threatened, because of recovery status, on July 12, 1995. Bald eagles concentrate in and around areas of open water where waterfowl and fish are available. They prefer solitude, late-successional forests, shorelines adjacent to open water, a large prey base for successful brood rearing, and large, mature tree for nesting and resting. The Tongue River may be an important seasonal migration corridor for bald eagles. The bald eagle occurs on the Reservation as a seasonal migrant as well as a wintering and breeding species.

Peregrine Falcon. The peregrine falcon was de-listed on August 25, 1999, and protection from take and commerce for the peregrine falcon is no longer provided under the Endangered Species Act. However, peregrine falcons are still protected by the Migratory Bird Treaty Act. (MBTA). Marginally suitable nesting habitat exists below the Tongue River Dam. Peregrine falcons migrate through the area during spring and fall, especially along rivers and other water bodies that support waterfowl and shorebirds.

**Table 6-17**- Available Wildlife Species on Northern Cheyenne Reservation in 1972. (HKM, 1972).

| | Available | | Estimated No. | Estimated No. |
|---|---|---|---|---|
| **Wildlife** | | | **Year Long** | **Seasonal** |
| | **Yes** | **No** | **On Area** | **On Area** |
| | | | | |
| Antelope | x | | 30 | |
| Buffalo | | x | | |
| Bear | | x | | |
| Deer | x | | 1,000 | |
| Elk | x | | | 2 |
| Moose | | x | | |
| Mountain Goat | | x | | |
| Big Horn Sheep | | x | | |
| Ducks | x | | | 10,000 |
| Geese | x | | | 100 |
| Pheasant | x | | 1,000 | |
| Turkey | x | | 100 | |
| Grouse | x | | 5,000 | |
| Chukar | | x | | |
| Partridge | | x | | |
| Quail | | x | | |
| Dove | x | | | 5,000 |
| Javalina | | x | | |
| Beaver | x | | 25 | |
| Muskrat | x | | 100 | |
| Mink | x | | 25 | |
| Otter | | x | | |

Source: Agency Annual Report, Land Operations, Outdoor Recreation and Wildlife, BIA, 1972.

## B. Aquatic Resources

The aquatic resources on the Reservation are diverse including some 32 different fish species. The current and exact status of the fishery on the Reservation is largely unknown. The major streams of concern on the Reservation are the Tongue River and Rosebud Creek. Rosebud Creek could support a game fish population with assured flow and temperature control. Rosebud Creek is not suited for trout, but it could support small mouth bass. This species prefers cool water streams with extensive riffle areas and clean bottoms.

In 1973, the Tongue River was sampled in the vicinity of the Reservation, and some data was generated regarding species composition and distribution. Small mouth bass have been established in the River and sampling showed this to be a reproducing

population. Other important sport fish included walleye, sauger, northern pike, and channel catfish. In addition, the Tongue River is unique in supporting the only population of rock bass in Montana. (HKM, 1973).

## VII. Forest Resources.

The Tribe recognizes the importance of their forests as a source of many benefits and strives to manage the resource to meet both commercial and non-commercial objectives. Therefore, the quality of Reservation forest resources is viewed as function of sustainable management of watersheds, wildlife, recreation, grazing and timber production. (Northern Cheyenne Tribe, 1989).

The management of forest resources is particularly important to the Tribe because of timber sales. Lumber has been and will likely continue to be one of the greatest sources of economic benefit to Tribal members. The condition of the forest resource and its associated economy is a concern. While management goals and plans are directed at the enhancement of the resource, the benefits derived from it have and will be at risk from a range of causes, including noxious weeds, woodland pests, fire and the market for timber.

### A. History.

The forests of the Reservation were first logged in the 1880s but logging virtually ceased until after World War II. Logging resumed in the 1950s, under the supervision of the BIA. Such activities were largely motivated by the need to rehabilitate the forests from a state of overgrowth and crowding. The condition of the forest was deteriorating due to fire suppression, insect infestation and over mature stands and it was feared that the resource would be lost to fire. During the 1960s, the role of forest management changed from fire protection and limited timber sales to one of active timber management. This included the development of the 1965 Timber Management Plan, a forest inventory and initiation of accelerated cutting. However, the development of long term contracts for timber sales was difficult. (US West Research, 1998).

#### 1. Northern Cheyenne Timber Association.

Throughout the history of the Reservation, BIA has played a major role in the management of Tribal resources, including the forest. During the late 70s and early 80s, the Tribe started to exercise self-determination. In 1985, the Tribal Council chartered the Northern Cheyenne Timber Association, which specified the following goals with regard to timber management. Nevertheless, the Reservation's timber resources remain under the direct management of the BIA.

- Promote a fair and equitable compensation to the Tribe and allottees for the development of Northern Cheyenne timber resources.

- Protect and promote the interests of tribal members involved in the timber industry on the Northern Cheyenne Reservation.

- Provide employment to qualified members of the Tribe in all categories of employment in the timber industry.

- Provide members of the Tribe with skills necessary for employment and promotion to supervisory and managerial positions.

- Promote, develop and operate tribal member businesses related to the timber industry.

- Preserve and protect tribal cultural resources.

- Facilitate the marketing of timber resources, and identification of such markets.

- Advise and work with the Bureau of Indian Affairs and the Tribe to develop the full potential benefits attainable from the management and development of Northern Cheyenne timber resources.

### 2. Integrated Resource Management Plan.

In 1989, the Tribe and the BIA developed an Integrated Resource Management Plan. This planning process was intended to facilitate Tribal decision making necessary for the management of their resources and to fulfill NEPA. The Plan initiated resource management, workshops to refine input, and alternatives for resource development. The Plan was compiled into a report and resource atlas consisting of maps created from a GIS database.

### 3. National Indian Forest Reservation Management Act of 1990.

Congress passed the National Indian Forest Reservation Management Act of 1990 because of the recognized difficulty and complexity associated with the management of Tribal forest resources and the need for increased self-determination. This act and law mandated the Secretary of Interior to consult with Tribes and to contract non-federal and independent experts to assess tribal forests. This group of experts was referred to as the Indian Forest Management Assessment Team. (IFMAT). The Northern Cheyenne Reservation was thereby classified as a Category 1 Reservation, or a major forested Reservation comprised of more than 10,000 acres of commercial timberland in trust or one having more than 1.0 MMBM harvest of timber products annually. This resulted in increased funding for the Tribe. The IFMAT stated that "Indians live intimately with the environmental and economic consequences of forest-management actions" and that they have a "well recognized commitment to protect the resources that are both their heritage and legacy."

The IFMAT made four findings relevant to the Tribe and the forest resource, these are:

- A gap existed between the visions that Indians express for their forest and how these forests have been managed by the BIA in the past.

- A gap existed in funding for managing Indian forests and comparable federal and private lands.

- There was a lack of coordinated resource planning and management for Indian forests.

- There was a need for better prescription and oversight of trust standards for Indian forestry.

### 4. Forest Management Plan

As a result of continued refinement in the management of the Reservation's forests, the Tribe and the BIA developed a Forest Management Plan in February 1999. This plan represents a comprehensive statement of forest management policies and procedures for the time frame 1998-2007. The Plan was partially based on a 1994 Continuous Forest Inventory (CFI) and sets the harvest limits. Tribal forest-wide objectives stated in the Plan are:

- To implement the Tribe's General Timber Harvest Agreement using sustained yield management practices.

- To bring the forest under management while mitigating environmental concerns and minimizing future resource loss to fire, insects, and disease. Currently, a high percentage of very dense, poorly growing pole stands poses a substantial wildfire risk. The Tribe wishes to ensure productivity of the forest by maintaining healthy stands, sustaining watersheds, and maintaining the forest land base.

- To sustain the Tribally-owned Tongue River Lumber Company and create training opportunities for Northern Cheyenne Tribal members and their spouses in all aspects of mill operations.

- To generate income for the Tribe and its members from the sale of timber.

- To develop procedures for effectively mediating land-use conflicts related to logging and road building.

## B. Tribal Forest Resources

The Northern Cheyenne Forest Management Plan (1999) states that 147,319 acres of land are forested and that 45,619 acres of forest were burned in a series of wildfires between 1983 and 1994. Most of that burned was commercial forest, 31,917 acres. The total acreage of commercial forest is 103,657 acres, of which 75% is Tribal Trust and the remainder individually allotted land. Table 6-18 shows a summary of the Reservation forestlands.

**Table 6-18** – Summary of Reservation Forests.

| Land Class | Acres | Percent Composition |
|---|---|---|
| Unburned Commercial | 71,740 | 48.6% |
| Burned Commercial | 31,917 | 21.6% |
| Inaccessible | 15,024 | 10.1% |
| Marginally Productive | 26,357 | 17.8% |
| Woodland | 1,461 | 1.4% |
| Stream Buffer Zone | 815 | 0.5% |
| **Total:** | **147,314** | **100.0%** |

Reservation forestland consists exclusively of ponderosa or yellow pine. Variation exists within the ponderosa communities resulting mostly from fluctuations in temperature and precipitation associated with elevation and slope aspect. Understory plant communities also vary.

Fire is an important part of the ponderosa ecosystems. Ponderosa pine communities are normally inhabited by fire resistant plant species, which require periodic fire to maintain healthy, sustainable conditions. The long history of fire suppression within the forests of the western U.S. and on the Reservation have led to less than optimal conditions, which are indicated by pest infestation, disease and tendency for large scale and intense fires. Because of the danger of catastrophic fire, much of the management of the forest is directed at stand improvement, through thinning. Since 1979, approximately 17,000 acres of ponderosa forest have been thinned. However, human-induced fires are a problem on the Reservation. An increase in population and development in the vicinity of the Reservation poses greater fire risk for the Tribe.

Information from the Integrated Resource Management Plan (1989) is presented on Figure 6-4 (Northern Cheyenne Reservation Forestland-Timber). The approximate locations of stand inventory plots, forest management units, timber compartments, tree planting sites, logging units and thinned areas are shown. Figure 6-5 (Northern Cheyenne Reservation Forestland-Fire) shows the approximate locations of historical fire ignition points, fire fuel breaks, fuel classification zones, and historical and present burn areas.

### C. Forest Products Economy.

The Reservation's 103,657 acres of commercial forest contains 280 million board feet of commercial timber. Sixty percent of that merchantable timber is 10 to 16 inches in diameter; the remainder is old growth timber greater than 18 inches in diameter. (Northern Cheyenne Tribe and BIA, 1999). Some of the old growth timber is reportedly infected with red rot. Of the timber logged on the Reservation, 85% is considered commercial sawtimber. The Forest Management Plan schedules logging of 60 million board feet of timber over the period 1999-2008.

The main historical market for harvested timber is the Tongue River Lumber Company (TRLC) in Ashland, Montana, however the sawmill is presently not operating due to financial difficulties. The economy of the Reservation has been strongly dependent on the success of logging and milling operations. Until recently, the TRLC employed 60 hourly and 11 salaried employees, of which 42 were Tribal members. In 1998, Tribal payroll consisted of 1.25 million dollars of a 2 million-dollar payroll. From 1988 through 1997, stumpage payments exceeded 6.2 million dollars. (Northern Cheyenne Tribe and BIA, 1999).

## VIII. Rangeland.

The primary land use within the Reservation is rangeland grazing. Within the Reservation there exist about 391,852 acres of rangeland with an estimated grazing capacity of 102,000 animal unit months (AUMs). (Northern Cheyenne Tribe, 1989). Recent estimates of grazing capacity specify 97,432 AUMs, which are managed by means of 101 range units comprising from 108 to 24,000 acres. The majority of animals are grazed under one permit, consisting of 41 sub-permittees, with the remaining units being leased to 30 individual permittees. (Northern Cheyenne Tribe and BIA, 1999).

Range units are not adequately cross-fenced, which results in distribution problems and overuse of critical areas such as riparian areas. These areas are declining in condition as indicated by stream bank destabilization, water quality degradation and loss of favorable vegetation to weeds and noxious weeds. (Northern Cheyenne Tribe and BIA, 1999).

### A. History.

Information about the early history of ranching on the Reservation was provided in Chapter 2. As discussed there, BIA mismanagement of the Cheyenne herds led to the near destruction of the Cheyenne ranching economy by the end of the 1920s. By the 1930s, most of the grazing allotments on the Reservation were held by non-Indians. In 1936 the Indian Bureau helped the Tribe start the Northern Cheyenne Steer Enterprise. This expansion of Tribal grazing activities was intended to involve more Indians in ranching on the Reservation. After the Steer Enterprise in 1957, non-Indian operators began leasing again. The Steer Enterprise was reestablished in 1962, to again promote more complete Indian use of Reservation resources. (BIA, 1969).

### 1. Integrated Resource Management Plan

Since the 1960s, the Tribe has progressively taken a more active role in the management of managed resources. Like forestry, range management efforts have been forwarded by resolution of all resource management needs in a collective manner. The Integrated Resource Management Plan represents one document that resolves resource use issues on the Reservation. Rangeland issues and management alternatives are addressed. Rangeland resources were mapped and show range management units, locations of water developments and vegetation types. (Figure 6-6 - Northern Cheyenne Reservation Range). The database is presently being updated.

### 2. Northern Cheyenne Tongue River Watershed Conservation Plan

The Tongue River Conservation Plan (1996) represents an assessment of watershed conservation alternatives, which identified and evaluated the following resource concerns within a 292 square-mile study area. The topics addressed include:

- Resource Concern
- Noxious Weeds
- Prairie Dogs
- Water Supply and Treatment
- Grazing Management
- Wildlife Habitat
- Range Condition and Trend
- Water Quality
- Culturally Significant Plants
- Recreation
- Ranch Income
- Land Use
- Soil Erosion
- Irrigation Water Management
- Riparian Areas and Wetlands
- Cultural Resources
- Forest Management
- Sedimentation

The Conservation Plan recognizes three alternatives of grazing management. The basic guiding principals involve adjusting stock rates to reduce forage selection by livestock, ensuring range units receive periodic deferment of grazing during the growing season, alternating season of use, and controlling time and intensity of grazing. The three alternatives presented are: A. High Intensity, Short Duration, One Herd, B. High Intensity, Short Duration, Multiple Herds, C. Rest Rotation, Multiple Herds.

### B. Tribal Rangeland Resources.

Grazing on the Reservation represents the predominant land use, with about 90% of the land area of the Reservation being suitable for grazing. Grazing occurs in the open unwooded areas as well as the commercial and non-commercial forest areas. Most grazing consists of cow/calf pair operations which turn animals out in April and May and roundup in October and November. Recently yearling operations are increasing, which run stock during the summer months. Most animals stay on the Reservation year-round. (Northern Cheyenne Tribe, 1989).

Tribal goals relevant to Reservation rangeland include:

- Use rangeland to produce income for the Tribe and Allottees in a manner that will maintain or improve the resource's productivity.
- Permit and lease rangeland to provide the greatest opportunity for Tribal members.
- Provide incentives to operators to undertake improvements to range units, such as development and repair of stock watering facilities and fencing.
- Control noxious weeds and prairie dogs.
- Change range permitting to provide for mitigation of impacts to operators resulting from other resource management activities, such as logging and mineral exploration.

### C. Grazing Economy.

The productivity of grazing on the Reservation is somewhat limited by the inadequate use of range units. Reasons for this include low cattle prices, inadequate hay production to sustain the herd though winter, shorter than optimal permit duration, inadequate distribution of hay produced and inadequate fencing and water development. Fencing and water distribution solutions are presently underway by means of the Tongue River Conservation Plan and the Tongue River Enhancement Project.

In the fiscal year 1999-2000, the BIA completed an appraisal of Reservation rangeland. A new grazing ordinance was enacted, and grazing permits were issued. The appraisal rate was set at $12.50 per Animal Unit Month (AUM). The council set the Tribal rates at $6.25 for original tribal land and $7.25 for acquired land. Authority was given to 2700 allottees, to grant grazing privileges. One hundred and ninety-five grazing permits were issued. (Little Coyote, 2001).

The total income produced by grazing permits was $748,501.56. Individual landowners received $200,635.67, and the Tribe received $547,635.60, constituting and increase of 22% over the previous year. It is estimated that cattle sales grossed $6,000,000, but expenditures, in terms of costs, investments and overhead, came to nearly

$4,000,000 (Bureau). Approximately 430,409 acres of the Reservation are leased for range units, farming, or home sites. There are currently 129 farm pasture leases, amounting to 18,099 acres, and totaling $80,412 in annual income. (Little Coyote, 2001).

## IX. Riparian Areas and Wetlands.

The Bureau of Land Management defines wetlands as areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include marshes, shallows, swamps, lake bogs, muskegs, wet meadows, estuaries, and riparian areas. Riparian areas represent a transition between permanently saturated wetlands and upland areas. Lands along, adjacent to, or contiguous with perennially and intermittently flowing rivers and streams are the most typical riparian wetlands on the Reservation. (BLM, 1992).

### A. Description of Reservation Resources.

Most of the wetlands on the Reservation are “lotic” ecosystems, defined as running water habitats supporting deciduous and coniferous tress such as ponderosa, dogwood, chokecherry, juniper, cottonwood, aspen and willow. Lotic ecosystems are found predominantly along the Tongue River and Rosebud Creek. Some “lentic” ecosystems are identified on the Reservation. Lentic systems are defined as temporary pools of water that dry up in the late summer and are important to migratory bird species.

The types of riparian communities on the Reservation include the broadleaf, the mixed broadleaf and conifer, the graminoid and forb, the shrub, and the mixed. (Figure 6-7). The Reservation contains approximately 20,000 acres of wetlands, which support 70% of the wildlife. (Rollefson, 2002). Wildlife species and cattle depend on the riparian wetlands for forage and shelter.

Most importantly, the Northern Cheyenne Tribal members use certain riparian plants for medicinal and cultural purposes. Based upon work done by William Tallbull, Assistant Professor of History-Dull Knife Memorial College, and Chairman of the Northern Cheyenne Cultural Commission in the late 1970’s and early 1980’s, it is possible to isolate wetland plants that are of cultural significance for the Northern Cheyenne. (Rollefson, 4/11/02). Tallbulls, *Plant Lore of the Northern Cheyenne*, outlines those plants found on the Northern Cheyenne Reservation that have historically provided medicinal or food value to Northern Cheyennes. Utilizing an ethno-botanical approach, a list of plants was accumulated through personal interviews with elders that are of significant cultural value. A proportion of these plants are hydrophytic, and therefore are located within wetland or riparian habitats. (Rollefson, 4/11/02).

Cross-referencing *Plant Lore of the Northern Cheyenne* with *Classification and Management of Montana’s Riparian ands Wetland Sites* and the *National List of Plant Species that occur in Wetlands*, produced the following list of Wetland Flora that are Culturally Significant to the Northern Cheyenne. (Rollefson, 4/11/02; Table 6-19). Mr.

James Bauder, Professor and Soil and Water Quality Specialist at Montana State University, is currently doing a study of the bioaccumulation of CBM discharge water by various salt tolerant wetland plant species and will produce the water quality tolerances of these plants to SAR and EC. (Rollefson, 4/22/02).

**Table 6-19** - Wetland Flora that are Culturally Significant to the Northern Cheyenne Tribe.

| **Plant Name** | **Scientific Name** |
|---|---|
| June/Service Berry | *Amelanchier alnifolia* |
| Red Osier Dogwood | *Cornus stolinifera* |
| Common Spike Rush | *Eleocharis palustris* |
| Horsetail / Field | *Equisetum arvense* |
| Wild Licorice / American | *Glycyrrhiza lepidota* |
| Goose Berry, Red Shoot | *Ribes setosum* |
| Mint / Field | *Mentha arvensis* |
| Horsemint / W. Bergamot | *Monarda fistulosa* |
| Water Plant / Water | *Nasturtium officinale* |
| Sweet Medicine | *Oxtropis (lamnbertii)* |
| ChokeCherry | *Prunus virginiana* |
| Cottonwood, G. Plains | *Populus deltoides* |
| Box Elder | *Acer negundo* |
| Green Ash | *Fraxinus pennsylvania* |
| Sand Bar Willow | *Salix exigua* |
| Snow Berry | *Symphoricarpos* |
| Cattails | *Typha latifolia* |
| Wild Plum | *Prunus americana* |
| Sweet Grass | *Hierochloe odorata* |
| Quaking Aspen | *Populus tremuloides* |
| Saw Beak Sedge | *Carex stipata* |
| Leafy Aster | *Aster foliacius* |
| Stinging Nettle | *Urtica dioica* |
| Bulrush | *Scirpus nevadensis* |
| Arrow Leaf | *Sagittaria latifolia* |
| Golden Currant | *Ribes aureum* |
| SkunkBush Sumac | *Rhus tribobata* |
| MilkWeed, Showy | *Asclepias speciosa* |
| Western Yarrow | *Achilliea millefolium* |
| Raspberry, Red | *Rubes idaues* |
| Rose Bush | *Rosa arkansana* |

This list and following text were developed for and taken directly from the Northern Cheyenne Reservation Wetlands Conservation Plan, as developed by Frank Desmond Rollefson in partial fulfillment for his Masters of Science Degree in Resource Management at Central Washington University, Department of Geography and Land Studies. In no way shall this information be usurped without citation and reference to the Northern Cheyenne Wetlands Conservation Plan, FDR 2002, developed within the Natural Resources and Environmental Protection Departments of the Northern Cheyenne Tribe, Montana.

### B. Condition.

A Riparian Health Evaluation, conducted in 1999 and 2000, found that the majority of the wetland habitats were classified as “unhealthy” (score of <60%). The causes for deterioration of the wetland environments include alteration of stream sections, removal of shrubs and vegetation along waterways, farming at the edges of streams and a concentration of livestock use. These activities result in erosion, flooding, reduced forage, damaged stream banks, and decreased water quality. (Rollefson, 2002).

Concentrations of cattle in riparian zones have caused soils to become compacted and eliminated stream-stabilizing riparian vegetation leading to stream bank failure. As a result, streams are wider and shallower allowing increased sediment and nutrients into the streams. (Northern Cheyenne Tribe and BIA, 1999).

### C. Management.

The management of riparian resources is important to the Tribe. Grazing management is one technique used to protect and restore riparian habitat. The Tribe is currently involved in the *Tongue River Enhancement Project*, which involves the development of stock water pipelines from wells and springs to distribute livestock and game throughout the Reservation and away from damaged riparian areas.

Another management technique is watershed management, where focus is placed on the entire stream system as opposed to site-specific treatments. The Tribe has developed *the Northern Cheyenne Tongue River Watershed Conservation Plan* to provide management direction and policy for natural resources. One expected result of the Conservation Plan is that riparian areas will exhibit a diverse stand of woody vegetation, both in the number of species and age classes within those species. (Northern Cheyenne Tribe, 1996).

The Tribe is currently developing a Wetland Conservation Plan. (Rollefson, 04/22/02). This plan addresses the extent and condition of wetland habitat and provides alternatives for managing the resources on the Reservation.

## X. Noxious Weeds.

Once established, non-native plant species can out-compete and eventually replace native species, thereby reducing forage productivity and the overall vigor of existing native plant communities. These detrimental effects to the environment are why non-native plants are referred to as noxious weeds. Category I noxious weeds are weeds that are currently established and generally widespread in many counties of the State of Montana.

### A. Species.

Noxious weed species of most concern on the Reservation include Russian Knapweed (Centaurea repens), Spotted Knapweed (Centaurea Maculosa), and Leafy Spurge (Euphorbia esula). Canadian Thistle (Cursium arvense) is widespread but not as threatening as the above mentioned weeds. (Denny, 2002). Colonization of an area is especially likely when surface disturbance occurs, such as road corridors.

Russian Knapweed (Centaurea repens). Russian knapweed will grow in cultivated fields, fence rows, roadsides, along ditch banks, and in wasted places. It is very poisonous to horses and it will give them a chewing disease (http://mtwow.org). According to Kirk Denny, there are approximately 5,000 acres of Russian knapweed on the Reservation.

Spotted Knapweed (Centaurea Maculosa). Spotted knapweed is an aggressive biennial or short-lived perennial that grows from 0.3 to 1 meter tall. The threat of spotted knapweed is greatest in range and woodlands dominated by Ponderosa pine or Douglas fir. Infestations cause soil erosion, decrease biodiversity, and reduce forage for wildlife and livestock (http://mtwow.org).

Leafy Spurge (Euphorbia esula). Leafy spurge is a persistent, deep-rooted perennial. It is found primarily in pastures, range, roadsides, woodlands and farmsteads. Leafy spurge plants contain a toxic substance, which causes scour, weakness, and even death in cattle. It is difficult to kill or control by chemicals; however, goats and sheep can be taught to eat it. (http://mtwow.org)

### B. Management.

The Tribe adopted a Noxious Weed Management Plan approximately ten years ago. The plan suggests the control of noxious weeds through biological, chemical, and integrated management techniques. It was developed by the BIA and is somewhat general as no Reservation-specific weed inventory was completed for the plan. An updated Noxious Weed Management Plan is needed. The Tribe is currently in the process of inventorying weed species on the Reservation and selecting high value areas for rehabilitation. (Denny, 2002).

## XI. Soils

The character and distribution of soil materials within the boundaries of the Northern Cheyenne Reservation are consistent with the surrounding region. (Bauder, 2001). Soil surveys were reviewed for Big Horn, Rosebud, Powder River, and Treasure counties, some of which are peripheral to the Reservation, revealing that the predominant soils are contiguous to southeast Montana. The entire southeastern Montana region, and specifically the lands within the boundaries of the Northern Cheyenne Reservation, are unglaciated, semi-arid high plains. (Bauder, 2001).

The Reservation is dominated by gently sloping to very steep, shallow to very deep, well-drained, sandy loamy, and clayey textured soils. These soils were formed in semi-consolidated sedimentary beds, baked sandstone and shale, colluvium, and alluvium on sedimentary plains, hills and alluvial fans. (BOR and the Northern CheyenneTribe, 1997). A generalized soil association map was obtained digitally from the State Soil Geographic Database. (USDA NRCS, 1996; Figure 6-8). Table 6-20 lists the soils shown on Figure 6-8.

The Delpoint, Yamac, Birney, and Cabbart soils are gently sloping to very steep, well drained, and loamy textured. (BOR and the Northern Cheyenne Tribe, 1997). Used mainly for range, these soils are within the 10-14 inch precipitation zone. The Delpoint soils are gently sloping to moderately sloping, moderately deep, formed in semi-consolidated loamy sedimentary bed, and are on sedimentary plains. Yamac soils are gently sloping to moderately sloping, very deep, formed in alluvium, and are on alluvial fans and sedimentary plains. Birney soils, very deep, loamy textured with numerous rock fragments, are formed in colluvium derived from baked sandstone and shale. Cabbart soils, moderately steep to very steep, shallow, are formed in semi-consolidated loamy sedimentary beds. (BOR and the Northern Cheyenne Tribe, 1997). The Havre soils are also well drained and deep soils that formed in alluvium. They are found on stream terraces and flood plains with slopes of 0 to 2 percent. (Northern Cheyenne Tribal Council and others, 1976).

**Table 6-20** - Areal Extent of Soil Map Units for the Northern Cheyenne Reservation

| STATSGO Map Unit | Map Unit Name | Area on Reservation (acres)[1] | Percent of Area |
|---|---|---|---|
| MT048 | Bitton-Shambo-Doney | 188,432 | 41.8 |
| MT070 | Bryant-Doney-Shambo | 56,503 | 12.6 |
| MT075 | Yamac-Busby-Cabbart | 29,433 | 6.5 |
| MT089 | Yamac-Birney-Cabbart | 122,365 | 27.2 |
| MT175 | Doney-Shaak-Wayden | 2,551 | 0.6 |
| MT321 | Lamedeer-Ringling-Twin Creek | 35,364 | 7.9 |
| MT668 | Yamac-Havre-Birney | 10,676 | 2.4 |
| MT676 | Yawdim-Delpoint-Thurlow | 4,320 | 1.0 |
| | | **Total** | **100** |

1 (area extracted from the GIS coverage)

Bryant, Shambo, Doney, and Bitton soils are gently sloping to very steep, well-drained, loamy textured and are mostly used for range. (BOR and the Northern CheyenneTribe, 1997). These soils are within the 15-19 inch precipitation zone. Bryant soils are formed in colluvium on sedimentary plains and are gently sloping to strongly sloping and very deep. Shambo soils are similar to Bryant soils and formed in alluvium and alluvial fans on sedimentary plains. Doney soils are gently sloping to strongly sloping and

moderately deep. They are formed in semi-consolidated loamy sedimentary beds. Bitton soils are strongly sloping to very steep, very deep, loamy textured with many rock fragments, formed in colluvium derived from baked sandstone and shale.

Lame Deer, Ringling, and Twin Creek soils are moderately steep to very steep, very deep, formed in colluvium and alluvium derived from baked sandstone and shale. (BOR and the Northern CheyenneTribe, 1997). They are used mainly for woodland. Lame Deer soils are well drained and loamy textured with many rock fragments. They are commonly found on hills. Ringling soils are excessively drained and loamy textured with many rock fragments. Twin Creek soils are well drained and loamy textured and formed in alluvium. This soil association are found on hills. (BOR and the Northern Cheyenne Tribe, 1997).

The Yawdim and Wayden soils are classified as well drained and shallow formed in material weathered from shale. They are located on uplands and have slopes of 8 to 70 percent. (Northern Cheyenne Tribal Council and others, 1976).